PROCEEDINGS

of the

90th Annual Conference

of the

American Railway Bridge & Building Association

1985

PROTECT YOUR INVESTMENT IN PEOPLE AND EQUIPMENT

★ Herbicide programs designed to provide the results you want

★ Custom engineered equipment delivers on target

★ Our experienced people put the right product in the right place.

★ Sprakil granulars formulated with **Spike**® ™ kill hard to reach areas like bridges, signals and material storage areas.

SSI/ACD MOBLEY ON TIME & ON TARGET

★ We have the solutions for your vegetation problems.

For more information call:

SSI INDUSTRIES, INC.
Huntington, West Virginia
1-800-624-3483

ACD MOBLEY CO., INC.
Kilgore, Texas
1-214-984-0270

Subsidiaries of Mobley Industries, Inc.

Proceedings of the

Ninetieth Annual Conference

of the

American Railway
Bridge & Building
Association

Held at

DALLAS, TEXAS

September 17-19, 1985

Copyright 1986 — American Railway Bridge and Building Association
18154 Harwood Ave., Homewood, IL 60430

TABLE OF CONTENTS

Page
Index to Advertisers 3
Officers for 1985 6
Officers for 1986 7
Session — September 17, 1985 11
September 18, 1985 43
September 19, 1985 93
Membership Report 55
Treasurer's Report 56
Audit Report 56
Necrology Report 57
Nomination of Officers 54
Report of Resolution Committee 119
Joint Installation of Officers 120
Past Officers 125
Constitution 131
By-Laws 134
Bibliography of Contents 187

ADDRESSES AND COMMITTEE REPORTS

Page
Address —
Donald H. Hoffman, President & Chief Executive Officer, Elgin, Joliet & Eastern . . . 15
Operation Lifesaver —
Joseph R. Beckman, Executive Vice President Corporate Communications, Chessie . . 20
Address —
A. Crane Jones, Jr., Vice President Engineering & Maintenance, Seaboard 25
Construction of the Ueno Underground Station for the Tohoku Shinkansen —
Chiaki Seki, Japanese National Railways 28
Duluth I-35/Railway Relocation Project —
Leroy Vague 37
Recycling Railroad Bridges —
J.R. Williams, Alfred Benesch and Company 39
Reconstruction of Collapsed Twin Arch Culvert at Lake City, Pennsylvania —
John T. Kapp, Project Manager-Construction, Conrail 43
Brittania Bridge —
D. Stewart Currie, Director of Civil Engineering, British Rail 49
Maintenance of Way Practices in Russia — Film Presentation 52
Committee Report —
Repair of Damaged Concrete Bridge Members, K.E. Bruestle, Chairman 59
Committee Report —
Mandated EPA Requirements for Asbestos Removal, R.E. Fronczak, Chairman 66
Reconstruction of Pipelines by the Instituform Inversion Process —
Lynn E. Osborn, Associate Technical Director, Instituform of North America, Inc. . . 82
Committee Report —
Methods of Inspecting and Repairing of Building Trusses
and Other Supporting Members, T.J. Parker, Chairman 85

Page

Committee Report —
Vandalism to Tools and Buildings, R.D. Patton, Chairman 91
Track Rehabilitation and New Construction in an Operating Environment at BART —
Vincent P. Mahon, Department Manager, Power & Way Maintenance, BART 95
Personal Computer for Preventive Maintenance System for Buildings —
Kenneth L. Kulick, Division Engineer, Amtrak 101
High Strength Concrete —
Dr. Henry Russell, Construction Technology Laboratories and
J.E. Cook, Gifford Hill Company 106
Panel Discussion —
Cross Tie Disposal 111

INDEX TO ADVERTISERS

Page

A&K Railroad Materials 137
Berkel & Company 139
Conley Frog & Switch 141
Detzel Construction 139
Dividend Information Center 143
DuPont 145
Enerpac 147
Fairmont 149
Foundation Equipment Company 151
Huck Industrial Fasteners 151
Intrusion Prepakt, Inc. 153
Kershaw Manufacturing Company 155
Koppers 157
Lewis Nut & Bolt Company 159
Little Giant Crane & Shovel 161
Loram M/W 163
Microphor 159
Midwest Industrial Products Corp. 165
National Railroad Construction 167
Osmose 165
Power Parts Sign Company 169
Rails Company 171
SRS America 173
SSI Industries . . . . Inside Front Cover
Shugart Manufacturing Company . . . . 175 & Inside Back Cover
Speno 177
Spider Staging Sales 178
Structural Rubber Company 178
Western Cullen Hayes 179
Professional Services Directory 180

OFFICERS
1984-1985

J.M. WILLIAMS
President

D.A. BESSEY
Senior Vice President

J.T. KAPP
Junior Vice President

D.J. LEWIS
Junior Vice President

P.H. SALETNIK
Treasurer

PAT WEISSMANN
Secretary

OFFICERS
1985-1986

D.A. BESSEY
President

J.T. KAPP
Senior Vice President

D.J. LEWIS
Junior Vice President

R.A. TALLENT
Junior Vice President

P.H. SALETNIK
Treasurer

P.A. WEISSMANN
Secretary

OFFICERS FOR 1985

J.M. Williams — *President*
Elgin, Joliet & Eastern

D.A. Bessey — *Sr. Vice President*
Chicago, Milwaukee, St. Paul & Pacific

J.T. Kapp — *Jr. Vice President*
Conrail

D.J. Lewis — *Jr. Vice President*
Illinois Central Gulf

P.H. Saletnik — *Treasurer*
Chicago & North Western

Pat Weissmann — *Secretary*
18154 Harwood Avenue, Homewood, IL 60430

DIRECTORS

Terms expire in 1985

T.E. Kuhn, Missouri Pacific	St. Louis, MO
D.R. Ladner, Chicago & North Western	Boone, IA
R.A. Tallent, Southern	Atlanta, GA

Terms expire in 1986

B.T. Burns, Atchison, Topeka & Santa Fe	Topeka, KS
J.J. Horney, Union Pacific	Omaha, NE
W.J. Semioli, Railway Track & Structures	Chicago, IL

Terms expire in 1987

D.W. Brookings, Kansas City Southern	Kansas City, MO
W.P. Cunningham, Missouri Pacific	St. Louis, MO
J.H. Smith, Illinois Central Gulf	Chicago, IL

PAST PRESIDENT

J. Budzileni, Illinois Central Gulf	Chicago, IL

OFFICERS FOR 1986

D.A. Bessey Envirodyne Engineers	*President*
J.T. Kapp Conrail	*Sr. Vice President*
D.J. Lewis Illinois Central Gulf	*Jr. Vice President*
R.A. Tallent Southern Railway	*Jr. Vice President*
P.H. Saletnik Chicago & North Western	*Treasurer*
Pat Weissmann 18154 Harwood Avenue, Homewood, IL 60430	*Secretary*

DIRECTORS

Terms expire in 1986

B.T. Burns, Atchison, Topeka & Santa Fe	Topeka, KS
J.J. Horney, Union Pacific	Omaha, NE
W.J. Semioli, Railway Track & Structures	Chicago, IL

Terms expire in 1987

R.E. Fronczak, Soo/Milwaukee	Chicago, IL
W.P. Cunningham, Missouri Pacific	St. Louis, MO
J.H. Smith, Illinois Central Gulf	Chicago, IL

Terms expire in 1988

E. Bond, Norfolk & Western	Roanoke, VA
D.L. Steele, Union Pacific	Omaha, NE
M.C. Walbrun, Amtrak	Philadelphia, PA

PAST PRESIDENT

J.M. Williams, Elgin, Joliet & Eastern	Gary, IN

Digitized by the Internet Archive
in 2011 with funding from
University of Illinois Urbana-Champaign

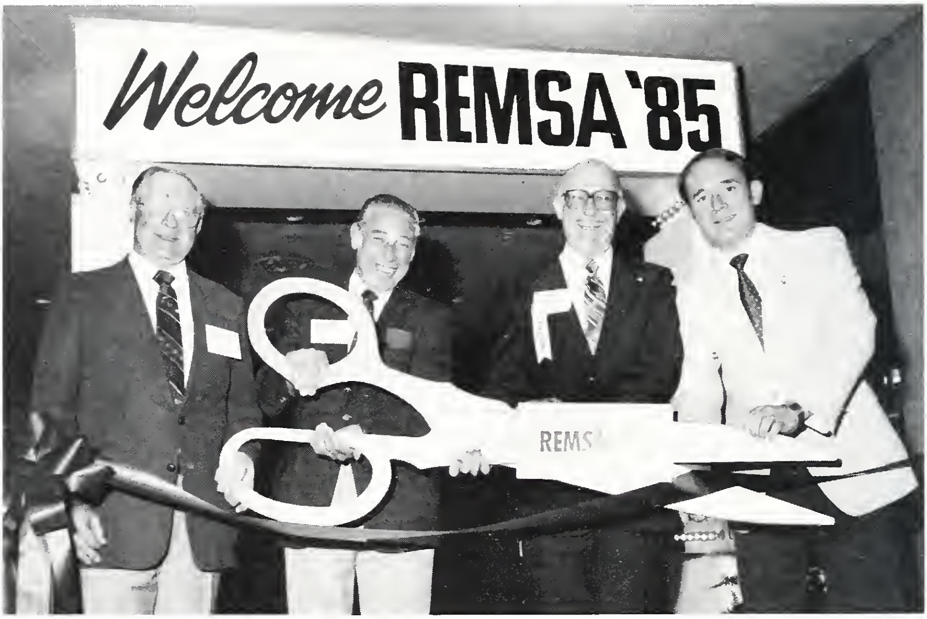
http://www.archive.org/details/proceedingsofann90amer

In Memoriam

Radford E. Dove, who retired in 1976 as associate editor of Railway Track & Structures magazine, and who had been prominent in the affairs of both the Roadmasters' Association and the Bridge & Building Association, died on September 26 at the age of 84 in a nursing home at Bensenville, Illinois. ''Bob'' Dove was born on February 17, 1901, in San Francisco, California. He had a career spanning 56 years in railroad engineering and magazine editing.

Dove received his engineering education at Northwestern University and Armour Institute (now the Illinois Institute of Technology). All of Bob Dove's railroad service was spent with the Milwaukee Road. He started in the service of the company in 1920 as a rodman and later served as instrumentman, senior instrumentman and assistant engineer. From 1944 until his retirement, Dove served in various capacities with the Simmons-Boardman Publishing Corp., including managing editor of the Railway Track & Structures Cyclopedia (now the Track Cyclopedia) and associate editor of RT&S magazine and the Railway Age. Dove edited the What's the Answer Department of RT&S for many years and was widely recognized as a competent track man and also was an accomplished engineering reporter and writer.

Dove served the Bridge & Building Association as president in 1941 and 1942. For many years he edited and published the Annual Proceedings of both the Roadmasters' and the B&B Associations. He was an honorary member of both these associations and was a life member of the American Railway Engineering Association.



Official Opening of REMSA '85 by the four association presidents. Left to right: P.R. Richards, AREA President; F.K. Semans, REMSA President; J.M. Williams, ARB&B President; D.E. Staplin, RMWA President.

Dallas Convention Center welcomes REMSA '85.

PROCEEDINGS

OPENING JOINT SESSION

Tuesday, September 17, 1985

The first Joint Session of the Roadmasters and Maintenance of Way Association of America and the American Railway Bridge and Building Association was called to order at the Dallas Convention Center, Dallas, Texas, on Tuesday, September 17, 1985, at 8:30 a.m., Mr. David E. Staplin, President of the Roadmasters and Maintenance of Way Association of America presiding.

President Staplin: Good morning. The 97th Conference of the Roadmasters and Maintenance of Way Association of America and the 90th Conference of the American Railway Bridge and Building Association is hereby called to order. Before proceeding on our program today, I would like to call on Tom Rosamond to give us a few words of divine inspiration. Tom, as you remember, is a former member of Roadmasters' Executive Committee. Tom.

Mr. Rosamond: Let us pray. Our heavenly Father, we come to you this morning as we open this conference, asking your guidance and your blessings on each one attending and in a day when many are fearful of traveling because of tragedies that have beset us this year, we thank you for a safe journey here on all who participate in this event. May your watchful care continue over us as we return to our homes. We pray that the business that is conducted and the presentations that are given during this conference will be pleasing in thy sight. May the knowledge that we gain throughout these days be used to improve the quality of life, not only for us but also for our fellow man. We are grateful for the opportunity of turning aside from our usual task for a few days and enjoy fellowship with old friends and establish new friendships. For those who attend this conference from other nations of the world, we're grateful, and we pray that lasting friendships may be established with them so that in some small way we may have a part in bringing forth peace that is so desperately needed in our world today. We ask you to bless the efforts for peace that will be made in meetings in the next few months, for we realize that the outcome will effect the entire world in the days ahead. As we ask these things of you this morning, we are ever mindful of your past blessings for which we are eternally grateful, and we pray that as a means of expressing our gratitude each of us will strive to be of more service to you. These things we pray in the name of our Lord Jesus Chrsit who made himself poor that we may be rich. Amen.

President Staplin: Thank you Tom. Those words are most appropriate this morning. In mentioning the opening of the Roadmasters and Bridge and Building Conference I think it is also fair that we recognize the many other events going on in Dallas at this time. I believe that we all feel a little bit like the kid at the candy store, because there's literally something here for everybody. We had the regional meeting, the technical conference, of the American Railway Engineering Association yesterday, and the opening of the REMSA exhibits on Sunday. And I believe at 1:30 today, Committee 32 of AREA will reconvene in a conference on the use of mini-computers in engineering. So there is something for everybody here. There are also ladies activities, including a trip to Southfork, which I think has been pretty well advertised. So we're really pleased by the variety of activities, and we hope you'll enjoy yourselves here.

At this time I would like to bring you up to date on the registration. So far we have a count of 372 Roadmaster members, 119 Bridge and Building members, 521 Associates, 214 AREA members, 529 guests, a grand total of 1,755. And to give you a little bit of a frame of reference, at this time in New Orleans, the last show year, we had a total of 1,456, so we are doing real well, and the registration indicates a high level of interest, which, in a period of a relatively soft economy in our industry, I think reflects the faith that our management has in these activities and in cooperating in our presentations.

I would like to introduce the officers and directors of the Roadmasters and Maintenance of Way Association that are seated at the head table. Those whose duties demand their

Opening Session, September 17, 1985.

presence elsewhere will be introduced at later sessions. Your officers are doing an excellent job in directing our association, and as President I can tell you that they sure make the President's job easy. They are a fine bunch. As I introduce each person I would ask that he stand and remain standing until all have been introduced, and I'll also ask you to hold your applause until all have been introduced.

On my extreme right, Director Keith Pottorff, Assistant to Chief Engineer, Atchison, Topeka and Santa Fe Railway, Chicago, Illinois.

Director Vince Mahon, Department Manager, Power and Way Maintenance, Bay Area Rapid Transit, Oakland, California.

Director Steve Hill, Office Engineer, Soo Line, Minneapolis, Minnesota.

Director Al Matte, Superintendent Maintenance of Way, CP Rail, Toronto, Canada.

Director John Smith, Division Engineer, Union Pacific System, Stockton, California.

Director Lester Kelley, Regional Engineer, Seaboard System Railroad, Jacksonville, Florida.

Director Ken Welch, District Engineer, Missouri Pacific Railroad, North Little Rock, Arkansas

Treasurer Ray Snyder, Assistant Chief Engineer Maintenance, Chicago and North Western Transportation Company, Chicago, Illinois.

Second Vice President, Mike Marlow, Supervising Engineering of Tracks and Property, Elgin, Joliet and Eastern Railway, Joliet, Illinois.

First Vice President, Wick Moorman, Division Engineer, Southern Railway System, Greensboro, North Carolina. You may now applaud.

Now I would like to turn the podium to Mr. Jim Williams, President of the American Railway Bridge and Building Association. Jim.

Mr. Williams: Thank you, Dave. Ladies and gentlemen, I join with President Staplin in welcoming you to this first joint session of our associations in Dallas. We certainly hope your visit will be rewarding and enjoyable. Program committees of our organizations have worked very hard in preparing presentations that will be given during the next three days. We feel that they will be a great benefit to you and your companies and I urge you to attend these sessions. As you know we left the afternoons open so that you can visit REMSA's exhibits in the convention center and also at the Santa Fe's East Dallas Yards. So you'll have no trouble finding your friends in the supply association and their exhibits, and you will also be able to attend these sessions and hear the reports of the committees. Even though the economic conditions have changed somewhat since our last conference in New Orleans in 1982, some restrictions have been placed on our companies pertaining to travel. A number of our members and colleagues cannot be here with us today, so we have the responsibility to take back to our properties all the knowledge and information presented here so that we can do our job in a more economical manner. Now I would like to introduce the members of the Executive Committee of the American Railway Bridge and Building Association who are seated at the head table. Those whose duties are required elsewhere will be introduced at a later session. I will ask that you hold your applause until all have been introduced. Your officers have been doing an excellent job in directing our association and have put together another outstanding conference program. If the gentlemen will please stand as their names are called and remain standing until all have been introduced. I will start at my extreme left, Director J.H. Smith, Engineer Buildings and Facilities, Illinois Central Gulf, Chicago, Illinois.

Director W.P. Cunningham, Utilities Engineer, Missouri Pacific Railroad, St. Louis, Missouri.

Director W.J. Semioli, Associate Publisher/Editor, Railway Track and Structures, Chicago, Illinois.

Director J.J. Horney, System B&B Supervisor, Union Pacific System, Omaha, Nebraska.

Director R.A. Tallent, Process Engineer Structures, Southern Railway, Atlanta, Georgia.

Director D.R. Ladner, Assistant Engineer, Chicago and North Western, Boone, Iowa.

Director T.E. Kuhn, Bridge Construction Engineer, Missouri Pacific Railroad, St. Louis, Missouri.

Junior Vice President, D.J. Lewis, Senior Structural Designer, Illinois Central Gulf, Chicago, Illinois.

Junior Vice President, J.T. Kapp, Project Manager, Design and Construction, Conrail, Philadelphia, Pennsylvania.

Senior Vice President, D.A. Bessey, retired Assistant Chief Engineer Structures with the Milwaukee Road and now Senior Architect with Envirodyne Engineers, Chicago, Illinois. The remaining gentlemen will be introduced at a later time. You may now applaud.

Ladies and gentlemen, it gives me great pleasure to present the President of the American Railway Engineering Association, who yesterday concluded their successful 1985 Fall Regional Meeting in this very location: Mr. P.R. Richards, Chief Engineer, Canadian National Railway and President of the American Railway Engineering Association. Mr. Richards.

Greetings from AREA

Mr. Richards: Thank you. Good morning. First I want to express very special greetings from AREA to the Roadmasters and Bridge and Building Associations. We have a tremendous REMSA show going on here now. I think it's extremely important that we support their efforts. They have gone to a lot of effort and expense to bring their equipment, machines, and materials to Dallas, and a grandiose exhibition for us to examine. Now we must compare and critique their efforts and of course in a positive

Indoor Exhibits of REMSA '85.

way. We had our AREA Regional Conference yesterday and yours starts today. You have a most interesting and very comprehensive agenda. We have a lot of problems to tackle in the railway industry and I think there always will be. Perhaps our associations should be called "PSA's" or problem solving associations. Only through and by that approach can we best assist our respective railroad companies to improve their position in the market place. Even though a lot of our companies compete against each other for traffic, our associations must work under the umbrella of learning new methods of getting work done, encouraging research and development groups, manufacturers and suppliers to develop what we believe is most needed and, thirdly, to exchange and share ideas with one another; always working together to find ways to reduce our costs. Again, very best wishes for a successful conference.

Mr. Staplin: Thank you, Phil. Again it's a pleasure to be in Dallas with the AREA, and I think the combined shows and AREA Regional meetings are maybe one of the best ideas that we've had. Now I'd like to introduce one of the people who represents the organization and makes a lot of what we see here possible, so without further ado I would like to introduce Mr. Frank Semans, President of REMSA. In introducing him, I would like to say "thank you" to REMSA for the fine job that they have done here in helping us set up this conference. Frank.

Greetings from REMSA

Mr. Semans: Thank you, Dave. President Staplin, President Williams, special guests, and ladies and gentlemen. As President of REMSA, I am honored to have been asked to join in welcoming the 97th Annual Conference of Roadmasters and the 91st Annual Conference of Bridge and Building. There are few organizations in the association field who can boast of the longevity of the Roadmasters and the Bridge and Building Associations. In fact, it's difficutl to recall such continuity in service among associations in any field. I know that members of REMSA join me in congratulating you and wishing you a productive 1985 conference. On behalf of our membership I would like at this time to present to Dave Staplin REMSA's gold pin award which reads "President, Roadmasters and Maintenance of Way Association of America, 1984-1985". Dave.

Mr. Staplin: Thank you, Frank. It's a real pleasure to be honored by REMSA in this way.

Mr. Semans: Also, to Jim Williams, I would like to present a matching pin which reads "President, American Railway Bridge and Building Association, 1984-1985". Jim.

Mr. Williams: Thank you, Frank. The help of REMSA is truly appreciated.

Mr. Semans: REMSA members are extremely proud to present REMSA'85. We hope you had an opportunity yesterday to see both the indoor exhibits here in the Convention Center and the outdoor working exhibits at the Santa Fe East Dallas Yards. We hope also that you will visit them again and again during the next two days. We'll see all of you this evening at the annual REMSA reception in the Reunion Ballroom at the Hyatt. Thank you very much.

Mr. Staplin: Thank you, Frank. At this time I would like to introduce Mr. Ron McDaniel, who is the first vice president of the Railway Engineering Maintenance Suppliers Association. Ron.

Mr. McDaniel: Thank you, President Staplin, President Williams, special guests, ladies and gentlemen. Thank you for giving me the opportunity to expand a bit on Mr. Semans' brief comments regarding REMSA's second annual reception. As you know last September we changed the format from a dinner to the reception. We believe that most everyone was pleased with this change. We hope you will enjoy this evening. There will be hot and cold hors d'oeuvres and music and entertainment. If you have not picked up your tickets you may do so at the REMSA ticket table in the lobby registration area in this hall until 4:00 p.m. today. Complimentary tickets are available for retired and registered railroad personnel and their spouses. The reception hours are from 6:30 to 8:00 p.m. We are looking forward to seeing you there. Thank you.

President Staplin: Thank you, Ron, for those words. We enjoy REMSA's hospitality at these meetings. You do a real fine job. At this time I would like to turn the rostrum over to President Williams who will introduce our first speaker.

President Williams: Thank you, Dave. Speaking of highlights, at this time it is my pleasure to introduce the keynote speaker for this first session of our conference, Donald H. Hoffman, President and Chief Executive Officer of the Elgin, Joliet and Eastern Railway Company. Mr. Hoffman also serves in the same capacity on the Bessemer and Lake Erie, and the Duluth, Missabe and Iron Range, as well as for five switching and terminal roads and a dock company.

Born in Mount Lebanon, Pennsylvania, a suburb of Pittsburgh on April 6, 1933, Mr. Hoffman is a graduate of West Virginia University, the Graduate School of Industry of the University of Pittsburgh, and the Advanced Management Program of the Harvard Graduate School of Business Administration. He served as a pilot in the United States Air Force, attaining the rank of Captain. Mr. Hoffman started his business career with United States Steel Corporation, which he joined in 1957 as a management trainee. He held various plant and Pittsburgh headquarters positions until 1973 whjen he was named General Manager-Labor Relations. He was elected Vice President-Personnel in 1978, which position he held until joining the railroads on November 1, 1982 as Director and President-elect. He assumed the presidency of the several companies on February 1, 1983.

As a lifelong Pittsburg area resident, Mr. Hoffman has been extremely active in community and civic affairs, including service as chairman of the board of the Port Authority of Allegheny County and director of the American Passenger Transportation Association from 1977 through 1981. He also served as director of the Southwestern Pennsylvania Regional Planning Commission, the Industrial Relations Research Association, the State Transportation Advisory Committee, and the Greater Pittsburgh Business Development Corporation. He is a member of the board of directors of the St. Clair Memorial Hospital in suburban Pittsburgh and is also a director of the Association of American Railroads, and of the Western Railway Association. Mr. Hoffman and his wife Mary have four sons. It is my pleasure to present to you Donald H. Hoffman.

Keynote Address

by **Donald H. Hoffman**

President and Chief Executive Officer
Elgin, Joliet and Eastern Railway Company

It is indeed an honor for me to be invited to address this joint Roadmaster/B&B morning session of your 1985 Technical Conference. The selection of Dallas as the location of this year's Conference also turned out to be a "fringe benefit" for me, as it provides the opportunity to visit a son and daughter-in-law who live in nearby Arlington.

My invitation stems from the fact that Jim Williams of our Elgin, Joliet and Eastern Railway is this year's president of the American Railway Bridge and Building Association. I would like to commend him, before this distinguished audience, for the dedication and hard work that have brought him to this post of top leadership in the Association.

Although our companies are small, as compared with the giants of the industry, we actively encourage our people to participate in the various trade and technical associations.

We look upon this as an excellent way for our representatives not only to keep up-to-date

Donald H. Hoffman

on the latest developments on the properties of our "big brothers," but also as providing the opportunity for our people to alert their peers to some of the innovative things we are doing on our roads. I wouldn't go so far as to say that, like Avis, we try harder, but is is a fact that smaller railroads often must be imaginative to survive.

At the outset, I would like to tell you a little about our companies.

The Elgin, Joliet and Eastern Railway, a small Class I, is our largest railroad. Its tracks form a half circle around the City of Chicago, and also nip into the northwest corner of Indiana to reach the Gary area. the EJ&E serves several major steel mills and chemical plants and has a fairly diversified mix of traffic. A unique feature of the "J" is that it connects with all of the major trunk lines entering Chicago.

We have two Class II railroads . . . the Bessemer and Lake Erie and the Duluth, Missabe and Iron Range. The Bessemer operates between the Pittsburgh district and the Port of Conneaut, Ohio, on Lake Erie, primarily moving coal north and ore and limestone south.

The Missabe's principal commodity is iron ore, which it hauls from various points on the Iron Range to its extensive storage and transfer facilities on Lake Superior at Duluth and Two Harbors. It serves several major taconite plants.

We also operate a number of Class III switching and terminal railroads in Pennsylvania, Ohio, and Alabama. To put it all in perspective, our companies in total operate about 2,500 track miles, own 400 locomotives and 26,000 freight cars, and have approximately 4,500 employees. Last year, we handled about 1,375,000 revenue cars.

If we were a single railroad with these statistics, we would still be only a moderately-sized operation as compared with the large-and-getting larger rail systems.

Separately operated, each with its own Board of Directors, our companies are not a "system," nor even a formal "group." But being small, widely scattered geographically, and including Class I and II regional carriers, as well as Class III switching and terminal roads, this informal group of affiliated companies represents an unusual, if not unique, segment of the railroad industry.

While there is no question that deregulation, on the whole, has been a boon to the railroad industry, we, and many other small or regional roads, are having serious problems with the ICC's implementation of the Staggers Act. Our own particular concern is in the area of "competitive access" for the EJ&E and B&LE.

The large systems have shown a great reluctance to cooperate with regional railroads in preserving or establishing joint routes and competitive rates that would enable the small roads to continue handling their traditional traffic movements. The Commission, by its actions, (or perhaps I should say "inactions"), has given the major systems carte blanche to wheel and deal about as they wish in getting traffic onto their long single-line routes, rather than requiring them to cooperate with regional roads and short lines in providing competitive joint routes and rates.

The problem, specifically, is that "regional roads" such as the EJ&E and B&LE not only connect with large systems like Conrail, Chessie and others, but also *compete* with them.

Frequently the regional railroads will have a joint-line route with a major road at the same time that particular major road has single-line capability between the same points. This puts us in a uniquely difficult position. We must both cooperate with and compete with the major systems. All too often, we are getting no cooperation . . . accompanied by a refusal to compete . . . and the ICC couldn't care less!

Our problems could get even worse in the future as the trend toward mega-mergers in the railroad industry continues. We could well end up in a very few years with only six or seven very large railroad systems moving most of this country's freight in single-line service.

The proposed sale of Conrail to the Norfolk Southern looms ominously on the horizon. Since both of these already huge roads service the same area of the country in which all of our roads are located, the competitive access problem could worsen dramatically for us if that sale occurs without some protection for the small regional roads. Along with officials of other railroads, I appeared before Congressman Florio's House Transportation Subcommittee on June 6, my statement stressing the need for preservation or reestablishment of competitive joint routes and rates involving the Bessemer and "J".

I just can't believe that the major systems really want to drive the small roads out of business. Yet, if they continue on the course they apparently have charted, this could well happen. The result will be less competition, which shippers certainly will not appreciate, with the giant systems eventually being forced to take over trackage of the small roads in order to continue the essential local services they now perform. Surely there is a place in this nation's railroad industry for both large and small carriers, and we intend to do everything possible to assure the survival of our own companies.

In addition to our Staggers problems and merger concerns, we also have been adversely affected by the current low level of activity in the steel industry, source of much of our business.

In an attempt to overcome these several adversities, we have been working hard to come up with alternative sources of revenue. While we are not big enough to support profitable piggyback operations, we have been moving into trucking through other options. On the EJ&E, for example, we have established an intermodal terminal that transfers products themselves from truck to rail, and vice versa, rather than transferring truck trailers, which allows us to reach customers not having rail sidings or shippers located on other railroads who desire our service. We also have an in-plant trucking operation on the ''J'' within the steel mills we serve, utilizing 60-ton off-highway units, in an attempt to recoup business we had lost to conventional truckers.

And last year we created a new subsidiary to provide over-the-road trucking service utilizing both company-owned equipment and owner-operators.

In another 1984 venture, we established a subsidiary company to our Birmingham Southern Railroad in Alabama to perform intraplant switching at the steel mill of our major customer . . . new business for us, more efficient and less expensive rail service for the industry. We hope to expand upon this successful concept by negotiating the takeover of intraplant switching for steel mill customers served by several of our other roads. And we are also taking a second look at items previously dismissed as of minor significance profitwise, such as offering surplus freight cars to customers at a special rate for use as storage vehicles; publishing local tariffs on one day's notice to compete better with unregulated truckers; seeking car, locomotive, and track repair work from industrial railroad operations in the areas we serve; and offering to sell our computer expertise to shippers and small railroads. We are dedicated to doing whatever needs to be done to keep our companies viable in this period of declining revenues in a climate of deregulation.

While I certainly am not an authority on the technical areas of expertise represented by those attending your Conference, there are several ''common sense'' observations I might make as to what top management expects from not only its maintenance of way supervision, but from its officials in general.

In addition to having a good ''handle'' on day-to-day operations, I think it is important that within each department, as well as at the corporate level, there be proper planning for the future. It is absolutely vital that management at all levels set aside time to plan ahead, in detail, if a company hopes to meet its goals of providing good service, holding down costs, and making a profit. And this forward planning should include positive steps to break away from the . . . quote, ''We've done it that way for years'' syndrome. There are a few things more harmful to a company than the perpetuation of questionable practices just because they are of long standing.

As you might imagine from what I said about the current business situation on our properties, much of our planning right now has to do with downdrafting to keep our expenses in line with the traffic being handled, and in coming up with new ways to, in the vernacular, ''make a buck.''

It is important also that procedures be established for the on-going measurement of performance; that is, cost compared to budget. It is easy to fall into a trap where performance that was entirely satisfactory last year or last month is accepted blindly today.

We have used a standard cost system on our properties for many years, with engineered standards and individual cost centers, which has been very effective in measuring results against constantly-changing standards.

In maintenance of way, for example, following purchase of a piece of new equipment, improved performance will usually insue as its use is properly planned and scheduled, and as operators become trained and proficient. This results in a decrease in the standard time to perform a particular function, and leads to a tightening of the original standards. But whatever you call it, and whether it is a formal system or an effective informal procedure that is well understood by all concerned, it is essential that performance be measured on a current basis.

Top management also expects its departmental managers to cope with the challenges brought about by change . . . which is a constant in the railroad industry.

The engineering disciplines represented by the members of your two Associations have probably experienced as much change in their respective departments, over the years, as in any other segment of railroading. New equipment, new materials, increased environmental concerns, added administrative burdens placed on you by federal and state regulations, and many others. I think it entirely possible that some of the REMSA exhibits you will be viewing here in Dallas this week will herald still further changes in your important departments. Each change is a challenge, and the importance of innovation and creative thinking cannot be over-emphasized.

We like to think, as I mentioned at the outset of my remarks, that railroad industry creativity and innovation are not confined to the major systems. With your indulgence, I would like to mention briefly a few recent projects on three of our companies that might serve as examples of small road creativity.

On the Bessemer, we are cooperating with the A.A.R. in a rail lubrication test on our main line, where we presently have wayside lubricators for curves only. The test is being conducted using revenue trains, and we will be installing locomotive flange lubricators on 20 locomotives. The lubricated flanges, in turn, lubricate the rail on curves and tangents alike, and our goal is to measure the effect on locomotive fuel consumption, wheel wear, and rail wear. The findings, which are expected by early 1986, will help us decide if we should convert entirely to locomotive flange lubrication or perhaps use a combination of flange lubricators and wayside lubricators.

Also on the Bessemer, when it was necessary to replace the deteriorated concrete deck of a ballasted railroad bridge over a U.S. Highway, a new bridge deck was precast in a portion of our locomotive repair shop during the winter months, delivered to the bridge site by train, and installed in late spring. This procedure reduced track time and interference with train traffic, improved manpower usage by precasting during the non-construction season, and improved quality control in the pouring and curing of the concrete, which, along with the use of expoxy-coated reinforcing rods, should improve life expectancy of the new deck.

A bridge redecking project on our DM&IR was handled in the same fashion, utilizing part of a car shop for the precasting work.

Precasting was also utilized on the DM&IR in the replacement of a 3,300-foot concrete deck of the 1916 double-track trestle serving one of our ore docks at Duluth. Missabe Road engineers conceived a unique design for off-site precasting of steel-reinforced concrete sections, which were placed by crane from ground level, over the six-month summer construction season last year. The project involved 535 precast sections, the largest weighing 40 tons, and the crane lifts ranged from 30 to 90 feet.

As construction was accomplished without significant interruption of dock operations, this structural repair project was completed much more quickly and at considerably less cost than if done by conventional methods.

The EJ&E's Maintenance of Way Department recently implemented an "INFO SYSTEM" computer program, utilizing a micro computer and a software package with spreadsheet, data base, word processing, and graphics capabilities to supply daily reports on labor, material, and equipment to the accounting department for payroll, inventory reporting, and a number of other purposes. The system also satisfies Maintenance of Way's own requirements for timely information in other formats upon which to base daily decisions, such as comparing equivalent men, material objectives, and billable projects with approved plans and budgets.

The flexibility of the "INFO SYSTEM" allows the using departments to output information in virtually any format required, providing an invaluable tool for a great variety of decisions, and immediate response to inquiries concerning labor, material, and equipment.

I would like now to touch on the matter of productivity, which, I feel, is of vital importance to the entire railroad industry in its goal of attaining and sustaining fair and reasonable profit levels over the long haul.

A recent booklet by A.A.R. Economist Frank Wilner effectively highlights the problem. The comparisons he makes are frightening: rail labor compensation up 204 percent from 1972 through 1983, versus only a 137 percent increase in the Consumer Price Index; annual rail compensation up $10,000 since 1980, while motor carrier compensation increased by less than $5,000; annual rail compensation, wages and fringes, averaging $40,972 in 1983, versus the $26,779 earned in the trucking industry.

This is a serious problem that must be resolved if railroads are to become more competitive with trucks and barges. The challenge is to find a way of getting the message across to our employees and their labor representatives that wage and work rules must be amended to meet today's competitive conditions. I am encouraged to believe that the recent national settlements negotiated in Washington represent a first step, or at least a gleam of light at the end of the tunnel

However, much more remains to be done in restraining labor costs by reasonable wage settlements and the elimination of antiquated work rules.

I very much appreciate this opportunity to give you some of my thoughts about current matters of interest in the railroad industry, as well as telling you a little bit about our companies. I am sure your meetings here in Dallas will be most productive, and that you will return to your own railroads with a wealth of useful information, as well as a renewed dedication to finding better ways to carry out your very important responsibilities. Thank you for your very kind attention.

President Williams: Thank you, Mr. Hoffman for an instructive and appropriate address. It reminds all of us that there are many common problems along with some unique problems in our industry, that our special disciplines must face and work out together. We know of your heavy schedule and also the ''fringe benefit of Dallas'' — since I also have a son and two granddaughters to visit in the area. So feel free to leave whenever you wish. President Staplin, I turn the rostrum over to you.

President Staplin: Thank you, Jim. At this time I would like to turn the program over to Mr. Ken Welch who is in charge of the program for the Roadmasters to introduce our next speaker.

Mr. Welch: Thank you, President Staplin. It is my pleasure this morning to introduce to you Mr. Joe Beckman. Joe is a long-time media and public relations specialist. He's been working in the field for over 35 years. Joe is from Elkhart, Indiana, where he grew up, and he's worked with both the UPI in New York and Chicago. Joe was with the Chicago Daily News before becoming a railroader in 1967 when he joined the Missouri Pacific as the public relations manager. In 1979, Joe changed railroads and went to the L&N; he is presently Assistant Vice President of Corporate Communications for CSX. In 1976 Joe became very active in the Operation Lifesaver function, and in the past year that has become a snowball; it has moved across the country growing in effort to promote grade crossing safety across the United States. Presently, Joe is also chairman of the National Safety Council Rail Highway Grade Crossing Committee, and it's my pleasure to present Joe to you this morning.

Operation Lifesaver

by Joseph R. Beckman

Assistant Vice President Corporate Communications
CSX Corporation

I appreciate the opportunity to appear here today to discuss grade crossing safety and Operation Lifesaver with you.

Actually, I'm trying to serve several purposes here. I'd like to bring up to date you folks who are aware of Operation Lifesaver and what it's trying to achieve, and I hope to acquaint those of you who don't know a lot about Lifesaver with the program. And I have one more purpose — to give some credit to the railroad engineering community for its part in the success of Operation Lifesaver.

First, I think I'd better make sure everyone here knows what Operation Lifesaver is, who's working on it , and so on. You who are already involved in the program, please bear with me.

Operation Lifesaver is an active, continuing public information and education program designed to help prevent and reduce accidents, injuries, and fatalities at the nation's 205,000 public railroad/highway intersections. It is sponsored cooperatively by the National Safety Council, federal, state and local government agencies, civic organizations and the nation's railroads.

The program is designed to increase public awareness of rail/highway grade crossing hazards and to improve driver and pedestrian behavior at these intersections. In connection with its educational phases, Operation Lifesaver emphasizes engineering improvements, including the installation and upgrading of warning signals and signs and the enforcement of existing traffic laws.

Therefore, these three areas of concentration — Education, Engineering and Enforcement — are what we call "The Three E's of Grade Crossing Safety."

This national public safety program had its start in Idaho in 1972 when the Union Pacific Railroad and community leaders in the state decided to band together and work toward greater grade crossing safety with a public education program. The results were dramatic. At the end of the first year, the grade crossing fatality rate dropped a whopping 39 percent. A second program was inititated in Nebraska with even more impressive results after a one-year period — a 46 percent reduction in grade crossing fatalities.

These two programs served as the models for other railroad-state Operation Lifesaver programs. Each state group approached the program differently, and that's still true today. Some implemented the program by establishing an extensive committee structure. Others managed to get the job done with a small, centralized group. But the key to success was a grass roots approach, with each OL program enlisting help from state, county and local levels of government, industry, the railroads and the general public.

Now, I'm not suggesting that grade crossing safety had it start on the UP in Idaho in 1972. Railroaders in several fields, notably engineering and safety, have been working at this as long as railroads have been around.

Among such efforts in recent years, though, Lifesaver *has* been a long-running campaign. It received a real boost back in 1977 when Kay Bailey, then chairman of the National Transportation Safety Board, recommended that the National Safety Council, a private, non-profit, non-governmental organization, serve as the OL umbrella organization.

The next year, the NSC took on the job and has brought to the program some dimensions and some organizational backing it might not otherwise have had.

Today the program is active in 47 states, and we hope to add the other two shortly. The 50th — Hawaii — has only six grade crossings, though we do get a lot of people volunteering to become state coordinator there, especially from the northern states in the winter.

Well, just how effective has Operation Lifesaver been?

In the 10 years, from 1975 to 1984, accidents have dropped from 11,354 to 6,633; injuries are down from 4,168 to 2,723, and fatalities have fallen from 978 to 610. These figures cover all highway users involved in accidents at public grade crossings. Clearly, education plus engineering — the installation of more warning devices — have had their effect.

These figures show considerable improvement obviously, but, as Federal Railroad Administrator John Riley, has said, they remain an anomaly. The OL program, in his words, is our "biggest success and our most perplexing failure." How do we reach motorists to teach them that we've got to stop meeting like this?

For those of you who were at the Highway-Rail Safety Conference in Kansas City last July, you may remember that U.S. Transportation - Secretary Elizabeth Hanford Dole announced - some recommendations that could lead to greater safety at crossings. She noted that the 1.6 billion dollars allocated to the states for crossing improvements have greatly reduced the physical and operational problems of the nation's most hazardous crossings. She then went on to say that many of the remaining crossings have rail and highway traffic volumes that are too low to justify installation of automatic warning devices. So she said that low-cost mechanisms must be developed to safeguard such crossings, if we want to bring down further the accident ratios.

To do this, Mrs. Dole said these low-cost alternatives would range from special pavement markings to grading and lighting improvements, from seasonal factors, such as winter snow removal, to brush control.

She added that Federal Highway Administration efforts to promote such alternatives on a corridor-by-corridor basis, including crossing closure, deserve support. She also said that FRA will make its field inspectors available upon request to evaluate risk exposure at existing crossings and to advise state and local officials on corridor resource allocation decisions.

And how to pay for this? She feels that the eligibility for funding through the Federal Highway Trust Fund should also cover such lower cost alternatives for crossings that can't justify automatic device installation.

We're glad to see the increased interest on the part of the Department of Transportation and its agencies in improving grade crossing safety. Working together, we can achieve even better improvement of the accident ratios.

The only other answer that I can see is to keep on doing what we've been doing. It's been a long, hard process — sometimes I think it's almost a one-on-one process — but it's been a successful one, and one way to improve upon it is to spread the program base even further, get more people involved.

That's another thing I wanted to talk with you about today, getting you folks consciously involved with the Operation Lifesaver program, if you aren't already. I realize I'm speaking to a wide range of railroad engineering people here, but there's plenty of work for everyone in Lifesaver, no matter what you do for your road. If I don't hit upon something that touches your work, just let me know — we'll find a way.

Obviously there are a lot of talks to be given, and if that's your thing, I know your state OL coordinator will be happy to have another warm body to send out on speaking assignments. If you don't know who your state coordinator is, just ask your safety department or your state railroad association.

If you don't care for public speaking, that's okay, because whether you realize it or not, there are a lot of other ways for you to help on Operation Lifesaver in your every-day work, particularly you who work out along the right of way.

I knew I wouldn't think of *all* you could do to help, so I talked with people in several departments — safety, engineering and law, among others — as well as representatives of the Federal Railroad Administration. They had a lot of good suggestions, so I've played reporter and put together the best of them for you. I warn you, too, that I'm going to mention some things that you probably already do as a matter of course, but please don't be insulted. All too often we look without seeing. Please use your minds as you use your eyes.

Division level supervisory people can hold departmental Operation Lifesaver meetings or discussions. You may assume that since your workers are railroaders, they automatically know what they should and shouldn't do at grade crossings. But, now and then — very infrequently, happily — there will be a report that tells of a railroader getting hit at a crossing in a railroad-owned vehicle. If you don't want to put on the program yourself, I'm sure your safety department will be glad to help. The message and the meetings can go to every employee in your territory.

At the same time you're doing that, you can make sure that both you and employees are better versed in talking about grade crossing safety when you and they meet community officials along the line. The laws differ from state to state, so be sure you know the grade crossing laws that apply in the state in which you're working at that moment.

Your rule books call for you to watch trains by. I can't imagine your failing to notice a diesel's headlight not being on, any more than I can imagine an engineer running a train on the mainline without automatically turning it on. But it could happen, and it could have a bearing on a grade crossing accident, so please consciously note the headlight.

As you drive along your railroad, either on the highway or when hi-railing, keep an eye out for the signage. Check the condition of the warning devices. If they consist only of crossbucks, make sure they are in good condition. As far as that goes, make sure they are present. They can get knocked down, vandalized or stolen. If the devices include flashing light signals, make sure the bulbs are working and that all lenses are intact. I'm aware of one accident that involved a set of flashers that had been damaged by vandals.

If you pass a crossing and the warning devices are activated with no train present on the circuit, make sure something is done about that immediately. If it isn't directly your job, alert the dispatcher, so he can get a signal maintainer headed toward the problem. I've occasionally heard of that problem existing for many hours. That causes motorists to disregard the flashing light signals and gates, both then and in the future. Further, few things around a railroad can get mayors, police chiefs, and city councils more riled up than warning devices activated for no apparent reason.

Make certain whistle posts are up, in their proper places, and in readable condition. It may be that veteran engineers know precisely where they should start sounding the airhorn for crossings without looking for the whistle posts, but younger or novice engineers may not.

Still on the subject of signage, you probably have some bridges along your territory. You're probably as aware as any railroader that many people believe that the best place to fish is from the center of a railroad bridge. This can be and has been highly dangerous for many individuals — fatally so for some — particularly when the bridge in question does not have a walkway.

So, when you're out patrolling, make sure the trespass warning signs are present and readable. It may not keep some trespassers off the bridge, but at least your road's law department will be glad to be able to say the signs were there in case of an accident.

Speaking of trespassers, whenever you encounter individuals on the right-of-way, warn them of the dangerous action they are engaged in, and tell them to leave the railroad property. I realize that's easy to say, standing here at a lectern in downtown Dallas. If it were me facing a 6-foot-5, 240-pound trespasser bearing a shotgun, I'm not at all sure what I'd do with my own advice. I may be a brave company man, but I'm not stupid.

However, there is more than one way to tell a person of the dangers and strongly urge him or her to leave the property. You can do it "tough guy" manner and make an enemy for your road, or you can do it in a more courteous but firm manner and perhaps make a friend for the road. After all, you're showing concern for the person's health and well-being.

Back to signage. If you're on the highway, you may note that an advance warning sign is missing or lost in a forest of brush. Or perhaps its location is badly placed. I can think of one such situation in which a road parallelling the railroad has a T intersection with another road just before the second road crosses a railroad. For reasons best known to that county highway department, the thin edge of the advance warning sign is located directly in the line of sight for the driver stopping before entering the main road. In short, if that driver makes a left turn into the main road, his first knowledge that a rail-highway crossing is present is when he travels a few feet and is on it.

Keep an eye out, too, for the painted "railroad crossing" warning markings becoming worn and faint.

In either of these conditions, let someone in the agency which maintains the signage know of the problem with the warnings.

I mentioned the brush that might be hiding advance warning signs. As you're aware, brush is a problem for railroads at grade crossings, too. One of the problems that sometimes surfaces is that when an accident occurs, the driver says that brush or weeds obscured his vision of the train. Make sure the quadrants of the crossing have as much sight-distance clearing as possible.

In some instances, there may be brush present, but it will be on a farmer's property rather than the railroad's. A courteous call to the farmer, perhaps showing him how the brush could keep a motorist from seeing an approaching train, could do the trick. Perhaps he won't be cooperative, but at least you've done your duty and have made an attempt at safety. Then, again, maybe he will do something about the condition, and had been unaware of its presence. As I said, too often we look without seeing.

That leads into a related subject on which my National Safety Council Rail-Highway Grade Crossing Safety Committee is doing some thinking. I'm not sure precisely how we should approach it, and I'd welcome hearing from you if you have some ideas.

What I'm getting at is the situation at many rural crossings late in the summer, just before harvest. The farmers who own the land in all four quadrants have terrific crops of corn, all tassled out and producing many ears. But that situation also could produce a grade crossing accident. As the driver goes along, his eye level several feet below the tops of the corn tassles, his stereo blaring, his windows closed against the heat and the air conditioning humming, he stands a good chance of meeting a train on a crossing equipped with crossbucks. Or he might strike the second unit or a freight car in the train.

A friend at the FRA proposes that farmers who have property adjoining the highway and railroad be asked to refrain from planting tall crops in sight-distance triangles, giving motorists an earlier view if there's an approaching train. They could plant lower-growing crops, such as soybeans, in these areas so the productivity would not be lost.

It seems like a reasonable thing to ask, doesn't it? And "ask" is the key word here. There's no way to order anyone to do something of this nature with his property. The question is, who's going to do the asking? My friend at the FRA suggests that track foremen or roadmasters spend one day a month making such calls on farmers. That's one possibility.

Another that we're looking at is to work through the Safety Council's agricultural safety department. Its people have a good program on farm safety going, and they have good contacts with state and county agriculture agents. My thought is, why not work through the NSC ag people to ask the local county agents to help in Operation Lifesaver, and in reaching the farmers?

If you have any other ideas, we'd sure appreciate hearing from you.

The final item I'd like to take up is the subject of crossing surfaces. That, too, is a problem that has a way of raising blood pressures in online communities. Many editorials have been printed and aired on the subject of rough crossings. No amount of talking with city fathers and news people will change anything until the crossing surface is made smooth. But there's a safety aspect to a rough crossing, too.

When it's known in a community that a particular crossing is rough, or — heaven forbid — that they all are rough, motorists tend to slow down approaching the crossing, keeping their eyes open for the least rough way to get across. Folks, when drivers are doing that, they *aren't* looking to the right or left, guarding against the possibility of an approaching train. And we aren't even talking about the claims sent to the railroad for front-end allignment, ruined mufflers, and the like.

Another problem connected with crossing surfaces that can become a safety consideration is the humped crossing. Low-boy truck trailers can get hung up on them, and if a train hits a truck of that type, the odds for a derailment rise considerably.

It has been suggested that one way to avoid or at least lessen this problem is to work with the city or county engineering department when you resurface a crossing. Through cooperation, they may want to place some blacktopping for several feet either side of the crossing. Both the railroad and the local government will be better loved by the citizenry for smoothing the approach to the crossing.

Well, there you have some of the ways we see you folks helping in improving grade crossing safety. I mentioned it before, but I think it bears repeating — use your mind as you use your eyes. Look for something missing or damaged or out of place. And do something about it. Make sure you report the problem, immediately if it's sufficiently important. Mention it in your weekly report, and if it isn't corrected in a reasonable amount of time, mention it again.

You people are an integral part of the Operation Lifesaver program on your railroad, whether you realize it or not. We need your help in so many ways. Remember the old saying that "if you aren't part of the solution, you're part of the problem"? I think that applies here. Please, be a solver, not a part of the problem.

Thank you.

Mr. Welch: Thank you, Joe. You've certainly given me some ideas and I hope some of the other members of the audience have made some mental notes; there's a lot of room for help from all of us. At this time I'll turn the rostrum back to President Staplin.

President Staplin: Thank you, Ken. That was quite an informative discussion. I'm sure we all benefited with some common sense approaches to the ways that we can help in grade crossing safety.

Our next speaker is Mr. A.C. Jones, Jr., Vice President of Engineering and Maintenance, with the Seaboard System Railroad. Mr. Jones' career with the railroad has been varied, and I'm going to condense it a little bit and give you the highlights. Before the Second World War, Mr. Jones was in train service with the Atlantic Coast Line and the Richmond, Fredericksburg and Potomac Railroad. During the Second World War he served in the Armed Forces, serving as a field artillery instructor. Upon completion of the war Mr. Jones attended North Carolina State University, Raleigh, North Carolina, and graduated from North Carolina State with a Bachelor of Science in Civil Engineering. Upon his graduation, he re-entered service with the Seaboard Airline Railway in the Engineering Department and worked his way through several positions to the point of becoming assistant division engineer maintenance for the Seaboard. In 1958 he made the switch to Transportation and again worked his way up the organizational ladder to the point that in 1970 Mr. Jones was promoted to general superintendent and chief engineer of our Georgia Railway group headquartered in Atlanta, Georgia. There he was able to combine both of his backgrounds into one position. Following that he became superintendent at Evansville, Indiana, for the Louisville and Nashville Railway and went on to become general manager transportation for the L&N. Moving back to Jacksonsville, Mr. Jones became assistant vice president of engineering for the Seaboard Coast Line Railway, still under the Family Lines umbrella, and later on the vice president of operations for the Seaboard Coast Line. Finally, upon coordination, what we call coordination at the Seaboard System, where the Louisville and Nashville and the Georgia Railways and the Seaboard Coast Line formally combined as one corporate entity, Mr. Jones was appointed vice president of engineering and maintenance with overall responsibility for Engineering, including Maintenance of Way, Mechanical Department and Communications and Signals. There are two special points of pride in introducing Mr. Jones. One of those is that during his tenure, even though our economic conditions have not always been favorable, our track improvement programs have continued at almost a record pace. Our property is in better condition than it has ever been before. So for those of us in the Engineering Department, we're grateful for his help in securing the resources necessary to make this happen. A second point of pride is that Mr. Jones is a long time member of the Roadmasters. So without further ado I would like to introduce you to Crane Jones.

Keynote Address

by A. Crane Jones, Jr.

Vice President Engineering and Maintenance
Seaboard System Railroad

A. Crane Jones, Jr.

Good morning. It is a pleasure to be in Dallas today and to have this opportunity to speak at this gathering of railroad people. The Roadmasters' and Bridge and Building Association conference is one of the industry's most worthwhile events, and I am pleased to see so many participants and attendees here. As a matter of fact, I wonder who's still back home running the railroad!

Kidding aside, I know that this meeting is what some people call a "work experience". And I am sure after looking at the line-up of speakers you have scheduled, that this will be the case. It always is.

As you may know, I am substituting today for Dick Sanborn, Seaboard's President and Chief Executive Officer, who was originally scheduled for this slot as keynote speaker.

Dick told me he was looking forward with eager anticipation to being here. Unfortunately a last minute conflict arose, and he asked me to substitute. This means that as a fill-in I'll try to cover some of the same ground he would — getting into such areas as the state of the economy, and the changing nature of our rail industry, before I have a few words to say about my specialty — engineering.

Before I do all this, I want to take a moment to thank Dave Staplin for arranging that a Seaboard representative be invited to fill this slot today. I would guess that Dave's being President of the Roadmasters and Maintenance of Way Association this year had something to do with it. So, Dave, I thank you for this invitation, and I'll do my best to live up to the Association's usual high standards for this part of the program.

As we move on toward the fourth quarter of 1985 the rail industry today finds itself in an economy that has been fairly soft — and which does not show any firm signs at this time of improved, sustained movement. On Seaboard we are fairly typical of the industry as a whole regarding total revenues thus far in 1985. We've had better years. On the other hand, by exercising careful cost controls across the board in all areas, we are still looking forward to a fairly good year. Important to this group, we all continue to see most major railroads investing in plant and equipment to the extent necessary to keep the nation's systems in very good shape. Maybe the old days of feast or famine for the mechanical and maintenance of way departments are really over. I hope so. And if so, depreciation accounting is to be given a great deal for credit for it. No longer does track work get funded out of whatever cash is left in the till. Now these basic expenses get budgeted right from the start of the year. Really, it's the only way to run a business.

So the consensus is that this year may not be all that bad for the industry, even though it's not going to break any records. The next questions is: where do we go from here? On this point I'll say that while no one yet has come up with a formula that accurately forecasts the economic future, I am not shy about saying that I am basically bullish about it. This is a wonderful country, with great resources anf fantastic people, and if we apply ourselves we will be successful.

Of course, given the strength of the dollar which so badly erodes our export markets, and the fever American consumers have for foreign-made products of all kinds, it is not always easy to remain bullish. Particularly when you realize that during the month of July foreign-made cars took very close to 30 percent of the American market. That is a new high, and while it could be another signal that the auto business is still accelerating its departure to points overseas, the fact is our own people haven't given up yet.

I refer to the recent announcement that General Motors will construct a new, highly-automated auto plant to build American-made subcompact cars in Tennessee near Nashville. This is a welcome development, of course. And I am also pleased the automaker chose a 2,400-acre site adjacent to Seaboard to construct its new Saturn facility.

I believe we can build a better car than anyone else and we can do it right here in America with American know-how and American labor. At Seaboard we support this project wholeheartedly, and have put such top priority on it that we created a new high-level position of "Assistant Vice President-Saturn Project" to coordinate all railroad operations into and out of the new facility. The person in this new slot reports directly to our Executive Vice President for sales and marketing. Never before have we had an officer of this rank responsible for service to a single specific plant — so you can see how important we think this new project is.

It will interest this particular group to know that the job includes, but is by no means confined to, helping engineer whatever trackage, layout and service the new plant may need, both for the inbound delivery of the component parts for automobile assemblies and outbound deliveries of the finished products.

Incidentally, we had no prior commitment for any rail business of any kind from GM. But we do know opportunity when we see it, and we intend to go after the business with all the innovative and creative transportation ideas we can muster. And that, in a nutshell, is the nature of the rail business these days. Now, with present-day deregulation, we have to go aggressively after the business that we have reason to believe may be out there and offer plans and services that fit the customers' specific needs.

We think these kinds of opportunities are available to the people who are willing to work for them. We also know we cannot just wait for the economy to turn around to bring us the business. Of course, a healthy economy helps, and I do see some hopeful signs out there, even though, as I said earlier, the turnaround the economists promised earlier for the fourth quarter does not seem to be materializing.

Among the hopeful signs I refer to are significant dollar investments in new facilities. In the second quarter, for example, spending on new buildings across the country rose at a 19 percent annual rate from the first quarter, and spending on durable equipment rose by just over 11 percent. One reason for this was lower interest rates, which have finally come down out of the stratosphere to more reasonable levels.

I do think with double digit inflation licked for the time being, and with interest rates at least manageable, that we are building the solid economic foundation for sustaining generally good business conditions for some period of time.

One important step in that process is getting the Federal budget under control. And I am pleased to see that both the White House and the Congress are making this a priority item, as they go back to work this fall.

I spoke earlier about our earnest efforts to seek more auto industry business. Certainly we are all aware that the nature and scope of our total traffic mix has changed, and is still changing. That means we must learn to live with it. We all know, by this time, that the growth era of "smokestack" America is over. And that means the role the railroads once filled to support the big industrial plants is gone forever.

I think we will see an even greater acceleration of this trend in future years. There will be even further increases in the use of foreign-made steel in this country, for example.

Other commodities we carry are now showing declining traffic volumes as well. For example, with so many Third World countries now self-sufficient in grain and food supplies, I think we will continue to see a decline in the big agricultural export markets we enjoyed just a few years ago.

On my railroad our largest source of traffic is coal. We have seen this business level off this year, with exports showing some abrupt declines. The strength of the dollar overseas and the low labor costs associated with mining coal in such countries as Poland, South Africa and now Columbia, has hurt our access to the world markets. Some additional business may come our way as the result of the present political and social situation in South Africa, but this is likely a short-term situation.

The bottom line is that railroads are carrying appreciably less traffic than in years past — and it looks to me as if this trend will continue.

This trend, which is long-term and not cyclical, has brought with it the down-sizing of our industry with fewer miles of track to operate and maintain, and a steady decline in the number of people who work for us. With management at all levels keeping a close watch on costs we have had to strive very hard to do our jobs more efficiently. There is no doubt in my mind that we have been successful in this regard, and management and our stockholders have done their parts by investing hundreds of millions of dollars in recent years to supply our shops and the maintenance of way forces with the very latest, state-of-the-art equipment that is available.

On this point I would like to pay my respects to the railroad supply industry people who are at this meeting. You have really come through for us with the equipment we need to do the job. Congratulations, and keep up the good work.

So we have taken some major leaps ahead in productivity. But I would caution at this point that from here on it gets tougher. The big gains — the easy ones — are behind us. Now we are going to find that we just can't buy productivity with a new machine. Rather, we are going to have to engineer it into the system.

For example, we have to get a better handle on what we need to do to get the track gangs into and out of a section of railroad, with least disruption to traffic flows. Those of us in charge of this work must work even closer with our transportation departments than in the past on scheduling — even to the point where we may want to think about this subject in more advanced planning of the actual work, giving more consideration to train operations over entire routes or corridors as opposed to district or division consideration; even to the possibility of detouring over competitive or alternate lines. I understand this is common practice now in Europe, for example, especially where passenger trains operate on very close schedules.

You know, much has been written about our industry's expanding piggyback business. Yes, we are handling more piggyback. That's the good news. But the bad news is some of this business is diversionary from the box car, and all of it is highway competitive, and that means it is only marginally profitable. As an industry, however, we are committed to going after it. We are making major capital expenditures for new terminals and new equipment. On Seaboard, specifically, we are putting in a very ambitious hub and spoke system connected by dedicated trains headed by new and fast locomotives specifically assigned to this work.

This has also brought with it a commitment to maintain main line track for high-speed service. It's expensive, but the only way to go if we are to remain in the piggyback business.

Of course, the key to our success in this area is still our ability under the terms of the Staggers Act to offer innovative services tailored and priced, for the specific needs of the customer.

The provisions of the Staggers Act have also proven indispensable to us for our other lines of business, particularly in our ability to offer contract rates making us a market-driven industry.

All of us in the rail industry are aware that Congress is being asked by some shippers to water-down the Staggers Act. This would be very destructive to our existence, and I encourage everyone to keep ever vigilant on this subject. I ask you to keep writing your Congressmen and Senators to support the Staggers Act ''as is'', and to request your friends and neighbors to do the same.

In closing today I want to say a few words about the role of maintenance of way officers in our industry. I must confess that since I am an engineer myself I am more than a bit prejudiced in this regard.

Be that as it may, I do want to say that I sincerely believe the rail industry has never before had a greater need for smart, creative maintenance of way leaders, particularly people who can bring new approaches and new solutions to our problems. This includes the people who work for our consultants, for the contractors who bid on our projects, and those in the supply field who furnish innovative and high production equipment. We welcome ideas, and we are always prepared to listen.

Those of us who are veterans in this industry, like me, need to continue to encourage those who have engineering talents to think seriously about working for the railroad. And once on the property, we need to continue to encourage them to keep their minds and ideas fresh and candid. Most importantly, we need to open our own eyes and ears, and pay attention to what they put before us. In return for their services we believe we can offer them first-rate challenges and rewards. We have a great future ahead of us in this industry, and bringing in new people is one very good way of assuring that the good things we now have will continue to take place around us.

Thank you for the opportunity to be with you. I've enjoyed it, and am looking forward to listening in on some of the presentations I see that you have scheduled, and I need to recommend to all of you the excellent exhibits that are available for your review.

President Staplin: Thank you very much, Mr. Jones. Due to Mr. Jones' extremely busy schedule I'd like to excuse him from the podium at this time, so that he may rejoin some of the people on the floor and visit the exhibits before he has to leave. At this time I would like to give you an idea of the updated count of attendance. We have 408 Roadmasters, 130 Bridge & Building, 531 Associates, 802 guests, 469 of our lovely ladies, for a grand total of 2,340. I'll now turn the rostrum over to Mr. John Kapp, of the Bridge and Building Association, who will introduce our next speaker.

Mr. Kapp: Good morning. Our second special feature will be presented by Mr. Chiaki Seki of the Japanese National Railways. The presentation is entitled "Shinkansen Construction" which includes the construction of 17 miles of two new high speed lines north of Tokyo that terminate at the city of Omiya. Included as part of this project is the construction of the four track Ueno Station 120 feet below grade, underneath a 17 track suburban station for regular passenger service.

Mr. Seki has been involved in the construction of various Shinkansen projects for 15 years and has been involved with solving various structural and environmental problems that have developed during the construction of the Shinkansen projects. Mr. Seki has been involved with research to study noise, vibration and snow problems in the operation encountered during construction of the Shinkansen lines. Would you please welcome Mr. Seki.

Construction of the Ueno Underground Station for the Tohoku Shinkansen

by Chiaki Seki

Japanese National Railways

It is a great honor for me to talk before this conference today, and I'd like to thank Mr. Michel of AMTRAK and those concerned for having given me this opportunity.

As you know, the United States and Japan have been involved in technical cooperation concerning passenger railways for years. A number of projects are in progress, not only here in Dallas, but in the Northeast Corridor Improvement Program, from Boston to Washington. The present level of our technological cooperation exchange has reached "maglev", the magnetically levitated train, which surpasses the technological level of the construction project of the Ueno underground station for the Tohoku Shinkansen which I am going to talk about today. I believe that passenger trains will replace cars as the main mode of regional-area transportation in the U.S.A. in the future.

For this reason, I will be very happy if my speech is some help for you. And also I am especially pleased to be able to speak here in Dallas, because here we know that the high speed rail project between Dalls and Fort Worth, with access to the Dallas-Fort Worth International Airport, is now underway. Now, I intend to explain the construction project of the Ueno Underground Station for the Tohoku Sinkanse with slides covering the following areas:

- The current Shinkansen Network in Japan and its future plans.
- The significance of the Ueno Underground Station for the Sinkansen and the summary of this project.
- The design and construction of the Ueno Underground Station.
- The Urban Renewal Project for the district surrounding the Ueno underground Station and the history of the district.

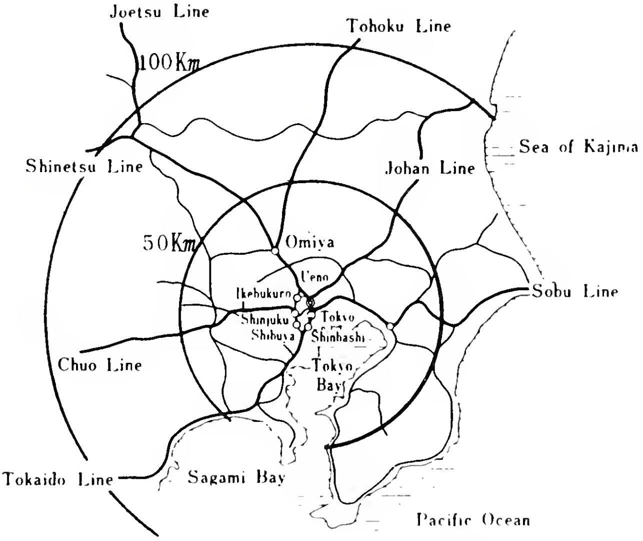
Please start the slides.

The Current Shinkansen Network and Its Future Plans

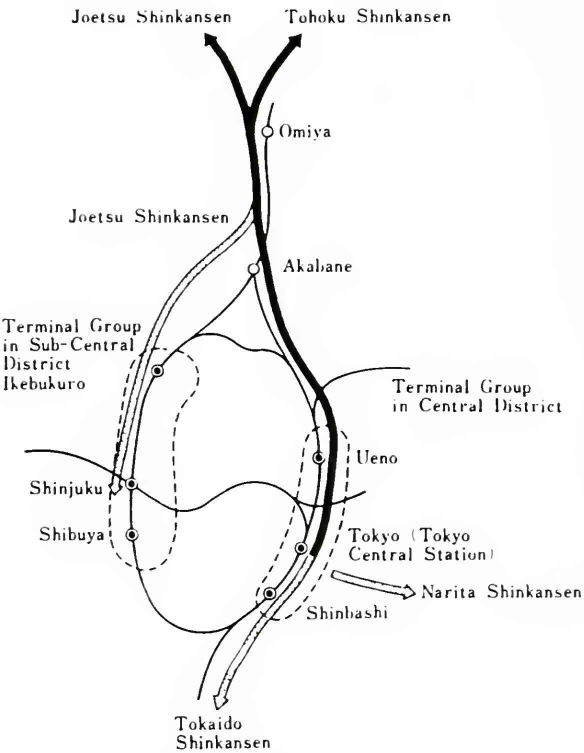
The first Shinkansen Line, the Tokaido Shinkansen, covering a distance of 345 miles between Tokyo and Shin-Osaka, was opened 20 years ago. That was in October 1964, when the Tokyo Olympics were held. Up to that time, economic activity in Japan had been divided into two blocks, Tokyo and Osaka. The opening of the Tokaido Shinkansen, which reduced the required travelling time from 6 hours 30 minutes to 3 hours 10 minutes, as you may know, caused a rapid change in the Japanese economy.

Next, the Sanyo Shinkansen was opened to traffic, first 100 miles between Shin-Osaka and Okayama in 1972, then a further 245 miles from Okayama to Hakata in 1975. Then followed the Tohoku Shinkansen for a distance of 315 miles between Omiya and Morioka, which opened in June 1982, and the Joetsu Shinkansen, which goes for 190 miles between Omiya and Niigata and was opened in November of the same year. And finally, the 17-mile section of the Tohoku Shinkansen between Ueno and Omiya, where construction had been delayed, was opened to traffic on March 14th, 1985. Thus, the high speed railway network in our country, whose trains travel at speeds of 130 miles per hour completed its first stage, and its total length reached about 1,250 miles.

For the time being, it is urgent to complete a section of about 2.5 miles which is still under construction between Tokyo Station and Ueno. However, the project for the line from Tokyo to Narita, which had been planned at the same



Present JNR's Network in Tokyo Metropolitan Region.



Network Terminal Plan in Tokyo Area.

time, has been and still is frozen, because the original plan with the purpose of airport access was altered to include urban transportation improvement in the Tokyo metropolitan area.

Our future construction plan includes: the section between Morioka and Aomori on the Tohoko Shinkansen, the Hokuriku Shinkansen from Tokyo to Osaka, the Hokkaido Shinkansen in the Hokkaido Region and two routes for the Kyushu Shinkansen in the Kyushu Region. The first two of these lines are to begin construction in the course of this year and are now being studied in detail.

Future plans such as the Ohu Shinkansen are drawn with dotted lines. Among them, the Chuo Shinkansen is now under study as a new kind of railway line using the superconducting magnetically levitated linear motor system which is the subject of a major project by the JNR Research Staff. This would provide both reinforcement of the Tokaido Shinkansen and a speed-up of travel between Tokyo and Osaka.

I have been talking about the present Shinkansen Network and the future plan. Now let me make a map of Japan using time required instead of distance, to show the influence of the Shinkansen Network in Japan. Blue shows the map before the opening of the Shinkansen. With the opening of the Shinkansen to Hakata it becomes as shown, red. Then, with the opening of the Tohoku and Joetsu Shinkansen and coming Shinkansen lines, Japan will be as shown in yellow. The construction of the Chuo Shinkansen using the linear motor system which I have talked about will reduce the time required for travel from Tokyo to Osaka to only one hour. As a result the long and narrow Japan, which stretches 2,190 miles from North to South, appears as a near circle with Tokyo as the center.

In the meantime, we are examining the present situation for further improvements. The maximum train speed in the world has been recorded by the French TGV. The design which has been adopted for the Sanyo Shinkansen between Okayama and Hakata as well as the Tohoku and Joetsu Shinkansen enables us to achieve a speed of 160 miles per hour.

However, in Japan, trains are obliged to run in *densely populated areas* and such high speeds necessarily cause environmental problems like noise pollution, so the trains are to run at a speed of 130 miles per hour. In the meantime, we have appealed to the public interest in the Shinkansen and have been continuing studies on noise countermeasures, vibration countermeasures, and so on. And finally, the Tohoku Shinkansen began running at a maximum speed of 150 miles per hour in March of this year when the Ueno Underground Station was opened.

Next, I would like to show you how the Shinkansen has become popular with Japanese people as an important mode of transportation.

This shows the number of passengers transported by the Shinkansen per year, and as you see, 130 million passengers used the Shinkansen every year except in 1975, the year of the so-called ‘‘oil-crisis’’. This is the same as if all Japanese people, even including babies and old people, used the Shinkansen once a year.

The main reasons why Japanese people use the Shinkansen so often may be its safety record. Safety is the most important factor for transportation, and since its opening the Shinkansen has not caused even a single passener death. I believe that you can understand our people’s great confidence in the system when compared with other transportation modes.

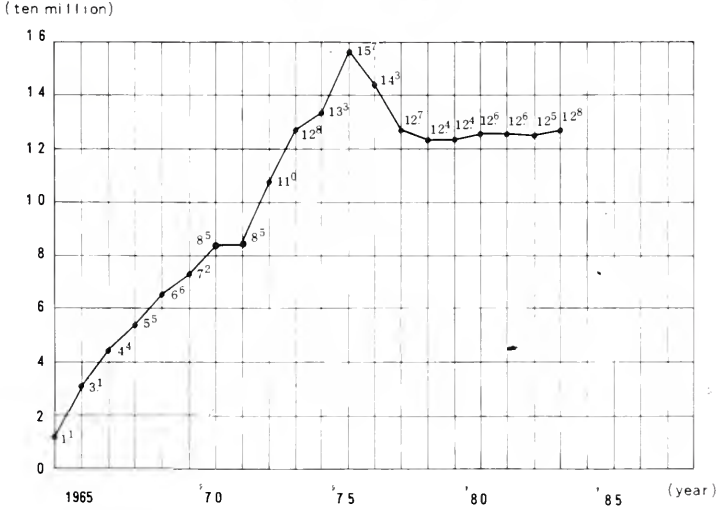
I have just discussed the current situation of the Shinkansen Network and future plans. Now I will begin the explanation on the main subject, the Construction Project of the Ueno Underground Station for the Tohoku Shinkansen.

The Significance of the Ueno Underground Station

First, let me explain the circumstances of this large-scale construction. The Tokyo Terminal Station Plan for the Tohoku and Joetsu Shinkansen did not include the construction of a new Ueno Underground Station, when the plan was put into execution in 1971.

At that time, we considered that the terminal station of the Tohoku Shinkansen was to be Tokyo Station, and that of the Joetsu Shinkansen was to be constructed somewhere in the Shinjuku area. These two lines were to be connected at Omiya. But later, the plan was modified so that the Tohoku Shinkansen now shares its line with the Joetsu Shinkansen between Tokyo and Omiya, because line capacity and terminal capacity are satisfactory enough for this common usage for the moment. And it was decided to re-

Number of Passengers carried in a year



build Tokyo Station as the Tokyo terminal for both the Tohoku and Joetsu Shinkansen, with four platforms and eight tracks. Shinjuku Station, which is located about six miles west of Tokyo Station, is the biggest urban railway station in Japan and has a huge terminal station which caters to 0.6 million passengers per day.

In Tokyo Station, the Tokyo area terminal of the Tokaido Shinkansen has used three platforms and five tracks since 1975. This terminal can handle 10 trains every hour to meet the demands of a large number of passengers, but it has inadequate flexibility in case of a schedule disorder, and its platforms can easily become chaotic. Trains in winter are often delayed due to snow interference, as the snow countermeasures on the Tokaido Shinkansen were insufficient. On the other hand, the Tohoku and Joetsu Shinkansen have had new technology based on long-term experiments for developing snow countermeasures, and the trains run on schedule even in winter.

Returning to the subject, taking into account the fact that the characteristics of the Shinkansen are its rapidity and regularity, it does not perform its functions properly if the schedule is not maintained. In order to assure reliable service, it has become necessary to provide three platforms and six tracks for the Tokaido Shinkansen. We can no longer meet present needs with three platforms and five tracks for the Tokaido Shinkansen.

Accordingly, only one platform and two tracks can be made available for the Tohoku and Joetsu Shinkansen at present. Thus, we have had to adopt some measures to increase terminal capacity.

Three propositions may be considered as possible measures. The first proposition is just to carry out the present project to expand the Shinkansen terminal at Tokyo Station to four platforms and eight tracks; the second is to construct another Tokyo terminal for the Tohoku Shinkansen; and the third is to establish a new subterminal to supplement Tokyo Station's one platform and two tracks.

We carried out a general examination of these propositions, taking into consideration factors such as the actual number of passengers, trends of city activity, access to various urban facilities, utilization of JNR-owned land, and we chose the third proposition. It has been decided that the Ueno Underground Station, with its two platforms and four tracks, will also serve as the Tokyo subterminal for the Tohoku Shinkansen.

Now I would like to explain the characteristics of Ueno Station in the Tokyo Metropolitan. Ueno Station, which is north of Tokyo Station, presently caters to 940 thousand passengers a day, and has the image of "the northern gateway of Tokyo". Three reasons explain this image.

First, the number of passengers in summer and at the beginning and end of the year is nearly double the usual passenger level. On these two occasions, during the Bon Festival in summer and in the New Year period, families gather together in their home towns in the country. A festival called "Kanto" is the Lantern Festival held on August 5-7 in Akita City. "Kanto" is a long and heavy bamboo pole to which is attached horizontal bars, from which lighted lanterns swing. The highlight of this festival is a parade of stout young men skillfully balancing "Kanto". "Tanabata", the Star Festival is celebrated on August 7 in Sendai City. People hang long narrow strips of paper in a variety of colors, or other coloful decorations, on the branches of a bamboo tree, after writing their wishes on them. A festival called "Hanagasa-Matsuri", the Flower Sedge-hat Festival is held on August 6-8 in Yamagata City. The highlight of this festival is a gala parade of people wearing round sedge-hats decorated with colorful artificial flowers. All three of these festival cities are in Tohoku and reached by the Tohoku Shinkansen. And 60 percent of the people who live in the Tokyo metropolitan area are believed to be from Tohoku and Hokkaido. That is why so many passengers use Ueno Station in this season.

Second, a large number of trains of the Tohoku, Joetsu, Shinetsu and Joban Lines use Ueno Station. Their long-distance passengers are different from the business travelers who use Tokyo Station in that many of them are not well accustomed to travel.

Third, Ueno Station, just like Shinjuku Station about which I talked to you a little while ago, and Ikebukuro Station in northwestern Tokyo, has the role of a transfer station for medium distance and suburban passengers from the Tohoku and Joban lines.

Thus, Ueno Station has an atmosphere different from that of Tokyo Station, but should be classed as a terminal station, like Tokyo Station.

Outline of New Ueno Underground Station: Basic Plan

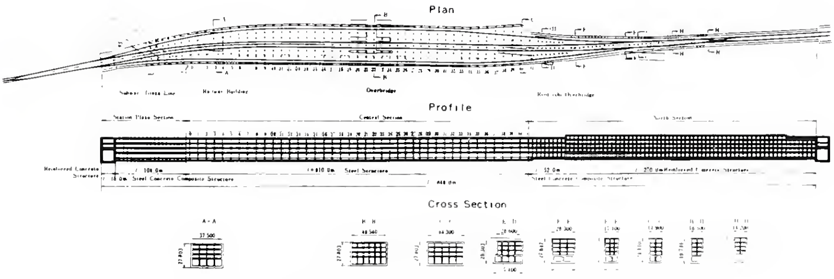
Now, let me talk about the outline of the New Ueno Underground Station.

As another large-scale underground station, JNR has Tokyo Underground Station, completed in 1972. In recent years, however, stations in big cities must be built within existing space because of urban circumstances, and New Ueno Underground Station is no exception. While the Tokyo Underground Station has some spaces such as plazas, there is no empty space at ground level Ueno Station. Therefore, a new underground station had to be built under the groun-level platforms of the existing tracks and the roads.

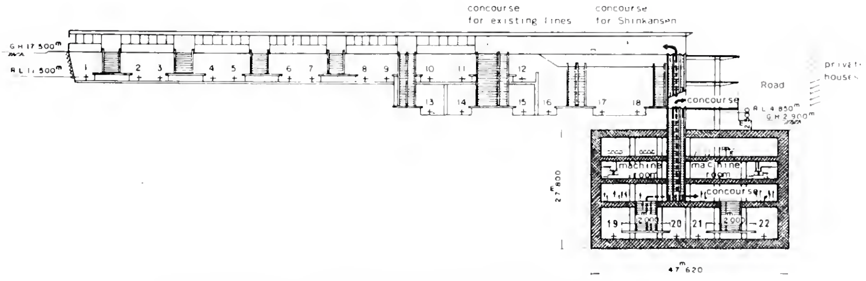
The Tokyo and Ueno underground stations differ from each other, in that the former is basically for urban traffic while the latter is a large-scale terminal station for the Shinkansen.

The quantitative basis for determining the structure size are both the railway traffic volume and the number of passengers, and for Ueno Station, we must also take into consideration the abnormal increase of passengers during the seasonal peak periods. Considering actual construction work, we have to take into account not only the large-scale construction, including the long platforms for the Shinkansen which must be 460 yards in length, but also various other requirements, for instance, passenger service facilities, facilities for on-board food, and huge waste disposal facilities.

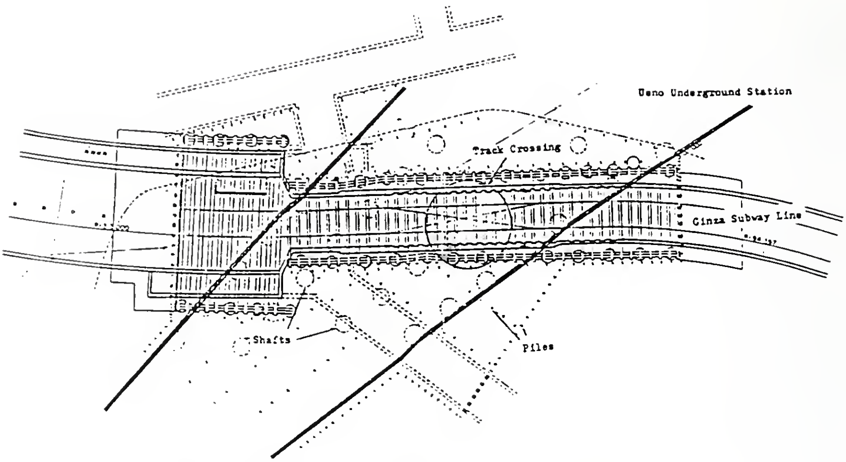
On the other hand, as the volume of traffic in the station increases, the smooth passenger flow becomes a serious problem both for prevention of disasters and for passenger comfort. It would not be going too far to say that whether New Ueno Underground Station succeeds or not depends upon how to plan smooth passenger flow, especially because many passengers of this station are not well accustomed to travel. After having studied these issues as a whole, it was decided that this station should be about 33 yards deep, about 52 yards wide and about 440 yards long. The structure should consist of four below-ground levels. The fourth level has the platforms of the Shinkansen, the third level is a concourse above the track, the second level has operating facilities such as machine rooms, and the first level has a concourse to handle the seasonal increase in passengers.



General Plan of Ueno Underground Station.



Cross Section of the Ueno Underground Station.



Plan of Supporting Works for Ginza Subway Line.

Then, for smooth passenger flow, this station is laid out so as to enable the passengers to feed into the ground floor from any level by escalators, in order to avoid passenger anxiety. For the connection with existing lines, Ueno Station is designed so as to connect the ground level floor with the third underground level, because this station is basically a terminal-type station.

This is the station after being opened for service. This is the platform level, this is the third level with the concourse above the track. We allowed a wide space for it, so that the passengers would feel as if they were not underground, and you will see that the escalators lead the passengers up to the ground. This is the ticket barrier on the first level. Finally, this is the connection concourse on the third level, where we have allowed wide spaces so that it is easy for the passengers to understand where to go.

Structure Type and Design Plan

When deciding the structure for the station, we had to investigate social conditions and conditions of the location, such as the natural conditions of the area. In Japan, earthquakes are the most important natural condition which must be considered. These examples show the damage caused by the earthquake which occured during the construction of the Tohoku Shinkansen.

As examples of social conditions, there are the peripheral urban environmental factors, such as environmental preservation, safety, and the efficiency and feasibility of construction work. This is the route of the Shinkansen. The construction of Ueno Underground Sation required temporary supporting of large areas: the station plaza for the existing lines, tracks, platforms, nearby roads, station building, etc. Therefore, for the underground excavation, the method of cast-in-situ pile by manual excavation and that of reverse construction sequence have been adopted because of the large scale of construction and for safety purposes. And taking into consideration the private houses contiguous to the line and to prevent influence on the existing lines, we have constructed a continuous underground wall around the underground station which served as cut-off wall and sheathing during construction. This wall became part of the main structure after its completion.

This is the structure of New Ueno Underground Station. The central part of the station where passenger facilities were built is a steel structure. On the other hand, the part of the station plaza which crosses Japan's first subway line, about which I will talk later, is made of a steel framed reinforced concrete structure.

I would like to refer briefly to the design plan. The structure of a large-scale underground station is marked by massiveness and by being under ground, and often shows many features different from structures on the ground. Because there are few similar constructions, we have quite a few unsolved problems in many areas.

Design calculation was done by supposing a model in the form of a box-shaped rigid frame. Support conditions and spring constants vary according to geologic features, etc. and there still remain some points to be solved concerning earth pressure; for instance, how it will act in an earthquake. The continuous underground wall part of the main structure was adapted to the double wall method to construct it. The one wall method is eocnomically advantageous but was impossible to use because of the difficulty of arranging the reinforcements during construction. In order to throw light on unsolved problems like these, as you see, we installed various kinds of measuring instruments in the course of construction, and measuring is still being continued. All the data are gathered in the measuring room.

Construction Plan

Now let me explain the construction plan. When executing this kind of construction work, it is necessary to secure working space under the ground, because as I noted, no space is available above ground. About three-fourths of the construction area was under the existing lines, so, after examination from various viewpoints, it was decided to proceed with the construction work by removing one existing track.

First, after having suspended the use of Track 20 at the side of the station next to the road, we installed work girders and platform girders, and supported them temporarily. Then, after having suspended the use of Track 19 and reopening Track 20, we temporarily supported Track 19 in the same way. Successively, we temporarily support each track through Track 17, and finally eliminated Track 20. The working space was obtained by using the space for Track 20 and part of the road.

The working space under the ground was procured by making the primary excavation; steel frames were built, the area was excavated by the method of cast-in-situ pile by manual excavation, and, finally, the lower levels were constructed from the top to the bottom, applying the reverse construction sequence method. This shows the section of our construcion in a completed state. These are some pictures which were taken while the station was under construction. Here we were setting the temporary support for the tracks. This is the hole excavated by the method of cast-in-situ piles by manual excavation for the building up of the steel frames. This shows how we built the steel frames.

Because we were working under ground, there are piles for temporary support, and steel frames were divided into pieces and welded again in the hole. Now you see the excavation. After finishing the excavation, slabs were laid down, and we excavated again. Finally, this picture shows the platform level. You have only to lay the tracks here, and the work will be accomplished.

Temporarily supporting the main structures, such as a station building, was another important problem in the construction plan. Now I would like to explain how we temporarily supported the subway which crosses here. There were two problems.

First, it has been 50 years since this subway line started service in 1929 as the first subway in Japan. Its construction has become obsolete, and we have only sketchy data on the construction plans of those days.

Second, an area about 90 yards long, which includes a part of Ueno Station of the subway line, crosses the railway line; at that point it crosses at an angle of about 45 degrees and, what is worse, it occurs at a switch.

On the first point, it was ascertained that this construction body has an SRC structure which was constituted by placing rigid steel frames at a pitch of five feet and tying with stringers. Based on the results of various experiments to determine its proof stress, we built an additional reinforced concrete wall, one foot thick, outside the construction body.

As to the second problem, allowable settlement is almost zero, due to the fact that most of the temporary support should be located around the switch because of the crossing angle of 45 degrees. After studying different methods for temporary supporting and taking these points into account, we decided to adopt the method of bearing by temporary supporting beams.

Now I will discuss the method used.

At first, we excavated down to the floor board level, then excavated again to build up temporary supporting piers, and built supporting beams. Finally, as I pointed out when I explained about the structure of the subway, we inserted temporary supporting beams into part of the rigid steel frame by trench cutting.

If we look at its section, we can see these are temporary supporting piers, and these are supporting beams, that is, vertical beams, and these are temporary supporting beams inserted along the rigid frames. This is a typical scene of the construction work. This is the main construction body of the subway line, and under it you see the temporary supporting beams inserted along the rigid steel frames.

Urban Renewal Project Concerning Ueno Underground Station of the Shinkansen

The future passenger terminal must have the following three functions as a composite terminal: a transportation function, a service function which satisfies passengers' demands, and a function of being a regional nucleus as a landmark. And to operate fully as a composite terminal, the terminal should match the urban renewal plans of the city authorities.

This is Ueno Station Plaza which was opened in 1883. And this is the prospective picture of the completed Ueno Underground Station. On the north of the station there is Ueno Park which has public facilities such as museums and zoos. Ueno Park is also famous for its cherry blossoms, and these trees are in full bloom in spring. One mile east of the station lies a very popular quarter called Asakusa. There are a lot of historical places like temples in Asakusa, and Japanese immediately think of Asakusa when they hear the word "shitamachi", which is used to describe the old part of Tokyo.

"Sanja-matsuri" is the festival for the temple at Asakusa. It is as famous as the festivals in the Tohoku region to which I referred a little while ago, and the fireworks festival of Asakusa is also famous all over the country. The famous "Kaminari-mon" is the gate of the temple at Asakusa. To the southeast of Ueno is the "Kokugi-kan" (the national sport center) and the Tokyo home of "sumo" which recently received favorable comments during a tour of the United States.

Thus, Ueno Station is located in a historical district with a typical Japanese atmosphere, and the planning of the future Ueno Station should be matched to such an atmosphere.

The construction of Ueno Underground Station, therefore, gave JNR and the city government a good chance to draw up an Ueno Station Area Renewal Plan. This picture gives an idea of the plans. The development of a new city image is now advancing using this plan. I'm sure that the vicinity of Ueno will become such a new city.

You might know that JNR, which is supposed to be transferred to the private sector in 1987, is in the middle of a period of major change. However, in Japan in particular, the railway will remain the main means of transportation between cities and within big cities, and further studies must be promoted to investigate both facilities and methods. Therefore, the introduction of the know-how developed through collaboration between America and Japan will certainly contribute to better rail transportation.

Finally, I would like to finish by thanking you for your kindness in listening to my speech in such uneasy English. Thank you very much for your kind attention.

Mr. Kapp: Thank you, Mr. Seki. Are there are questions? If not, I'll turn the rostrum back to President Staplin.

President Staplin: Thank you, John. Thank you also, Mr. Seki, for a fascinating presentation. It appears as though there are a lot of common problems between the two countries when you go to build something in the middle of a congested area. At this time I'd like to turn over the podium to Mr. Ken Welch who will introduce our next speaker.

Mr. Welch: It's my pleasure at this time to call on Mr. Leroy Vague of the Minnesota Department of Transportation. Leroy is a Northern Minnesota boy. He was raised in Minnesota and has worked there all his life. He has been associated with all the railroads in the State of Minnesota, since he's been with Minnesota Department of Transportation for 26 years. He's now a railroad engineering specialist with MN/DOT, particularly involved with railroad negotiations. Some years ago Leroy got involved with the planning phase of the I-35 construction through Duluth, Minnesota, and with all the various railroads and governmental agencies. He found it to be rather a sticky wicket so I think you'll find this very interesting. If you will, here's Leroy Vague.

Duluth I-35/Railway Relocation Project

by Leroy Vague

Minnesota Department of Transportation
Minneapolis, Minnesota

I had what I thought was a huge project, but I don't think it can compare structurally with what we've just seen, but our bureaucratic entanglements might rival that project. There are at least two unusual things about a project of this type, the most unusual being that a state department of transportation would dare to manage a large rail relocation. We normally stay out of that. The second thing is that we would be up here or anywhere talking about such a project. Public agencies don't do much of that. We spend a lot of our time apologizing and explaining why we spent Federal funds but it was decided early on in this project that we would capture it on film from Day One, and we've done that, right through the last couple of weeks; even have gone so far as to have an original folk tune, written and performed by one of the staff members, that ends the show. It's done from a bureaucratic involvement standpoint. It is not as technical as perhaps you might expect, but I'm going to come back after the presentation and show a small group of specific slides.

(Where upon there was a slide presentation with the accompanying remarks)

Come, let's go for a ride. You'll miss the story if you don't ride along. Perhaps, I should say, you'll miss the stories, for the trip ahead is several stories rolled into one.

Where are we going? We're heading for a place in downtown Duluth, to a strip of highway that was going nowhere because of a railroad yard. Now, it's not the nature of a highway to simply end, to stop abruptly, to run into a rail yard. No, a highway is intended to extend, to allow you to continue, to finish a trip that you've begun.

This, then, is where our story begins. The place is Duluth, Minnesota. The year is 1976. This abruptly-ending road is Interstate 35. The extension of this road needs to be under construction by September, 1986, or Federal-Aid Interstate Funding will be lost. State and local officials had made a very difficult decision in 1976, a decision that took six years to make. They decided that Interstate 35 would be built between Duluth's central business district and the waterfront. This meant that a railroad yard called the Bridge Yard serving five different railroads would have to be moved from Duluth to nearby Superior, Wisconsin, by November, 1984.

Eliminating the Bridge Yard meant building a new railyard for one of the railroads, upgrading three other railyards, and improving 17 miles of mainline track for the four railroads, converting 11 different branch lines into a mainline, and constructing five new connections.

We are talking about a project that involved the largest publicly funded track relocation in U.S. history. We are talking about a project that cost 45 million dollars and took 9 years to complete.

The Minnesota Department of Transportation (MN/DOT) was managing a project that had to satisfy five competitive railroads. Agreements had to be obtained from Federal agencies, State agencies, various shippers, and property owners. Approval or rulings on such agreements were required from 23 different public agencies. During the nine years, MNDOT dealt with 12 prime contractors, more than 50 subcontractors, 16 work sites, 19 work contracts with 50 supplements, more than 400 billings, and 200 front-line people representing the railroads, local governments, and other parties.

It took four years before the first agreement with a railroad was reached. To get the first step underway was perhaps one of the hardest steps in the whole project. It meant for all concerned that concrete action was finally beginning. The project would finally get off paper and the construction could begin.

In 1980, the Duluth, Winnipeg and Pacific Railway Co. agreed to the specifications of a new yard and grading for this new yard finally began.

Just for a moment, consider the patience and endurance required of the people working for that agreement. The invisible network and layers of organization that both MN/DOT and the railroads had to influence and coordinate were staggering. After a meeting when state and railroad personnel worked together toward a joint agreement, each would have to go back to an enormous constituency of people. Each would have to convince unions, financial people, operational people, and those responsible for industrial development that this joint agreement would serve all diverse needs and interest. And somehow, step by step, 19 contracts later, they would cross the finish line, the deadline set for 1984.

If you ask the individuals who worked on this project for nine years, ''What were the highlights? . . . What do you remember?'' before you even finish the question, they'll smile and say, ''We finished it. That's the highlight.'' And the way they smile and the way they say the words tell you more than their answer.

If we could add up all the details of the project over the nine years, we could begin to appreciate why the people involved with the project, describe the highlight as ''It was finished.''

Of course, it would be impossible to add up all the details, but we can view some of the accomplishments. First, let's take a look at the new railyard for the Duluth, Winnipeg, and Pacific, the DWP Railroad at Pokegama, south of Superior. One person described it as building a mini-city. For although, MNDOT's responsibility was to functionally replace each of the railroads' facilities, most of the railroads chose, on their own, to expand and improve their operations as did the DWP.

Next came the three upgraded rail yards for Burlington Northern, Chicago and North Western, and Soo Line. Consider the vast impact of the move on each railroad and in turn all the people affected by each of these railroads.

Moving the railyards away from the center of the population enhanced the safety and aesthetics of the community, and also the surrounding community received an economic boost in a period of recession.

Now, let's look at the miles of new track that were laid for the Duluth, Missabe & Iron Range Railroad, complete with new crossings, new connections, and state-of-the-art technology, like the continuous welded rail.

Certain technological advances were made such as the steel ties that you see here. These steel ties were imported from Australia to replace wooden ties on an experimental basis, because it was hoped that the steel ties would last longer and resist buckling. Also, if steel ties proved to be better than wooden ties, there was a potential for a whole new industry for the Iron Range.

A major technological accomplishment was the installation of Centralized Traffic Control for monitoring and dispatching trains. One of the by-products of this CTC, involved the Oliver Bridge over the St. Louis River. Although this 50-year-old bridge was still serviceable, its steel decks would short out the electric current of the CTC.

A method had to be found to insulate the rails from the steel deck bridges. This insulator also had to be able to withstand the tremendous weight of the trains and Northern Minnesota's climate. Ten-inch polyethylene pads with steel fasteners were specially designed to insulate the rails from the steel deck bridge.

With some of the these details and accomplishments in mind, let's go back to where our trip started. Back over nine years to where the project finally merged and connected, crossed and intersected just as the new extended highway will do soon and as the new railway system now does.

This is where our story ends, or I should say where our stories end: the ''physical story'' of actually picking up the old railroad Bridge Yard and laying down a new one, elsewhere; the ''human story'' of many individuals and groups of people from various agencies working together, meeting, coordinating, agreeing and making the project happen; and finally, the ''fairytale-like'' story of a seemingly impossible task, the idea of moving a railyard, a concept on paper that came to life. This was to make way for a highway to continue, so our ride can go on, so we can finish the trip we've begun.

That's it. So as not to deny the hardcore track constructors their fix I want to show you some of the specifics. If the project is the sum of its parts, here are some of the parts. This is Soo Line stuff. We had water, we had clay; more mud, and again more mud mixed with snow, until we were up to our axles. And that's red stuff. Soo Line got into the black stuff. One of the key parts of this project which has not been talked about, I'm sure, is the geotextiles used. I'm not an expert and won't pretend to be, but I'm assuming that some of the fabric experts documented this project, because we used a lot of it and had tremendous amounts of drainage problems, water, etc. The water tower — how many times has a department of transportation built a water tower? I had to bring a picture of that along.

These are the 200 steel ties and really just a factional part of our project but an interesting part. I understand that the United States railroads have been quite conservative in their rush towards ordering steel ties, but Canada awarded a contract last week for 200,000 steel ties to be placed on 72 miles of mainline, and there's the possibility yet of a steel tie company in Canada.

The last thing I want to talk about is the first problem that we had and that was the acquisition of right-of-way. That of course has to be done to build any project, and there were some landowners that weren't particularly happy with our acquiring their land. That's it for Minnesota. (Applause)

President Williams: Thank you, Mr. Vague. Are there any questions? Your presentation is a challenge to all of us showing what can be done when everybody works together to complete a project of this magnitude.

At this time I'd like to have the B&B Chairman, John Kapp, make the next introduction. John.

Mr. Kapp: Thank you. Our next speaker is Mr. Jack Williams who is currently the Senior Bridge Engineer with Alfred Benesch and Company. Mr. Williams graduated from the University of Colorado in 1946 with a Bachelor of Science in Civil Engineering. His background includes geophysics exploration in North and South America and as design engineer for the Bridge Department at the Rock Island which he served for 17 years as the engineer of bridges. Mr. Williams should be a familiar face to many of us here, as he is past president of the B&B Association.

His presentation today is entitled "Recyling Railroad Bridges". Please welcome Mr. Jack Williams.

Recycling Railroad Bridges

by J.R. Williams

Alfred Benesch and Company
Chicago, Illinois

Good morning. It's a pleasure for me to address the combined session of the two associations. As a past president of the B&B Association it's like "old home week" to be up here. I imagine that the bridge people in the audience wonder what an ex-railroad bridge engineer is doing up here talking about recycling railroad bridges when they do it everyday. If you bear with me however, you will see two or three innovations in railroad bridge construction that may still be novel to you.

Planning

A couple of years ago the Soo Line elected to have Alfred Benesch and Company design a new bridge across the Menominee River in Kremlin, Wisconsin. The new bridge was to be built on a offset alignment to replace an existing bridge which consisted of three through pin connected truss spans and a total length of 400 feet. The bridge was constructed in 1899 and was designed for the light trainloads of that era. One of the reasons that Benesch was chosen as the designer was that we proposed to use second-hand girder spans in the new construction. In 1946 the Rock Island Railroad constructed a line between Ainsworth and Righton in central Iowa. After the demise of the Rock Island, this formerly high speed mainline was abandoned. All of the spans in the bridges on this line were designed for coopers E-72 and for steam impact. The design exceeded current design requirements fo cooper E-80 with diesel impact. The Trustee of the Rock Island offered to sell us spans for the price of number one melting scrap in the Chicago market on the date of the sale. This came up to $80 a ton versus $1,800 to $2,000 a ton for new steel.

The assistant chief engineer of bridges and structures of the Soo Line and I inspected the spans on the line segment that we proposed to use in the new bridge. We found the spans to be in excellent condition and okayed their use in construction. The Soo Bridge is located in northeastern Wisconsin. The Menominee River is the dividing line between Wisconsin and Michigan. The river, although relatively shallow, is swift. Soil borings were obtained at each end of the proposed structure. It would have been quite expensive to obtain borings in the river, because barge-mounted equipment would have been required. Since the top of the rock was about the same elevation on each side, and soundings across the river indicated this could also be true in the river, it was decided not to attempt to obtain borings in the river but to incorporate changes in the top of the rock elevation into the pier design, since all piers would be founded on spread footings.

The pier design provided for the pier shaft to be extended five feet higher and assume shaft height. Reinforcement was detailed to accommodate this. All pier shafts and pier footings had the same process. The rock graded from a shale on the Wisconsin side to a basalt on the Michigan side. I understand that when the Wisconsin Highway Department wants to construct a bridge across the waterway they just do it. A private bridge owner has a different set of parameters to go by. Permits had to be obtained from: the Wisconsin Department of Natural Resources or DNR, the Michigan DNR, Corp of Engineers, Merrionette County, Wisconsin, Soil and Erosion and Sediment Control, Menominee County, Michigan, Soil and Sediment Control. Permits covered both the construction of the new bridge and the demolition of the old. Wisconsin and Michigan DNRs have different and conflicting requirements, and until this was resolved we began to wonder if the bridge was going to look the same on both ends.

One of the requirements was that the new structure could not raise the water level more than one-tenth of a foot. Although the new bridge was almost 200 feet longer than the old we had to run a hydraulic study using the Corp of Engineers Hec II program on our computer to prove that it would not raise the water level.

Other requirements were that any area disturbed doing construction shall be seeded and mulched, rip rapped, or otherwise stabilized to the satisfaction of the Wisconsin and Michigan DNRs. Michigan DNR requires a separate permit to cover construction of all roads, temporary structures, or other structural appurtenances to be placed on or over bottom lands. Wisconsin DNR requires that no heavy equipment shall be opreated in the waterway at any time unless written notification is made to the Water Management Investigator at least five working days in advance. No work shall be done in a stream during a period of above normal flows except if necessary to prevent soil erosion. These requirements go on and on. The successful bidder on the reconstruction of the bridge was Lunda Construction Company of Black River Falls, Wisconsin. Let's see how he fared building a bridge within these parameters. May I have the lights please? (A slide presentation followed.)

Construction of Substructure

Because of all the red tape the work didn't start at the best time of the year. This is November; existing bridge is on the left.

Work progressed from the Michigan side to the Wisconsin side. Barge mounted equipment was used to handle relatively light pier construction loads.

Dragging of sheet piling, forming of pier shafts, proceeded. Insulated forms were necessary because of the low temperatures to keep the concrete temperature to specified level. Part of the contractors brought in equipment. Work progressed in spite of the weather.

Setting and driving of the sheet pilings proceeded. The basalt in the river allowed sufficient penetration of the sheeting to hold the sheet piling.

Next came drilling the rock and excavation of the pier. Preparing to blast; detonation of the charge. Lunda was always thinking, and they brought in a special bucket that has needle sharp teeth on it and found that they could clam the basalt out of the excavation, and this eliminated any further blasting — a very resourceful contractor.

This is the excavated rock after that bucket had worked it over.

Reinforcement shaft tension bars are being place in the bottom footing.

All reinforcements are in place now for casting the footing. Diagonal tension or diagonal bars were used in the footing.

For this particular pier the contractor had to go quite deep to find sound rock. The pier shaft design worked well. The contractor used just one form for all of the piers. Here the insulated pier shaft form is being positioned on top of the cast footing. Pier shaft casting is complete; insulation has been placed on top of the form holding the heat of hydration so that freezing won't occur.

Here's preparing to remove the two-piece form. All of the pier shafts were of identical design except for the heighth. This enabled the contractor to use one set of forms for all of the piers. As you can see, the Menominee can turn into a white water river.

This is the start of the removal of the two piece forms. Note in the upper lefthand background the gravel causeway out into the river. This is a seemingly impossible thing to maintain with the velocity and flow of the river. Lunda made it possible by setting two rows of jersey barriers into the river and filling in between with gravel and boulders. As you probably know, jersey barriers are those contoured concrete blocks used to construct crash walls to keep vehicular traffic out of highway and roadway construction. They worked quite well.

Girder Retrieval

Concurrent with the substructure construction, the contractor had to retrieve the secondhand spans from the abandoned Rock Island mainline. He elected to remove and transport them completely assembled.

This is a portion of his retrieval equipment. He calls this a launching girder. Note that there are rails on top of it. These are bogies that ride on those rails.

This is an assembled section of it.

Beams are placed across the bogies, and new jacking frames are set onto the beams. The rods are of extremely high strength steel, and they are threaded full length. They go down and under to attach the needle beam under the span to be retrieved.

Jacks, rods and bogies are in place. The rods are attached to the cross beam. Those rods don't really look as if they can take the load, but they do.

Gasoline powered pumps were used. We're ready to start to lift. The span is starting up; it's up about six feet. Here the raise is completed. This particular span weighed 53 tons. It's 75 feet long. Trailer wheels are set in place underneath the span. The movement of the span off the bridge was started. At this point, the jacks and rods on this bogie will be removed. The span is moved off the bridge supported on the left by the trailer wheels and on the right by the bogie and rods.

Placing the Super Structure

The span arrives at the Soo bridge at Kremlin. It is sandblasted prior to painting. Painting is continued during inclement weather inside a plastic shelter. Sandblasted surface and primer with a subox coating were used.

Span 7 is transported to the bridge from the storage area and set in place.

Span 6 is then set in place and Span 4. Here again the jersey barriers are working very well, and the crane is sitting on the causeway. Span 4 is in place.

Span 3 is the longest girder, 80 feet long. It weighs 66 tons and is the most difficult to set. It was transported from the storage area to the bridge and set at a temporary location on Span 7.

This span is sitting on top of the other span and the gadgets between the two spans are called "Hillman Rollers". These rollers are a very useful tool in this type of bridge erection and span retrieval. They can be designed for almost any load, 500 tons, or whatever you need. These were designed for 100 tons apiece.

Because of the current, the contractor could not build the causeway out from both ends to set Span 3. Here it is being rolled out on top of the other spans to Span 4. Pulled with a cable from the abutments, now within crane range, it is set in place.

Span 2 is set with the causeway holding up quite well. Finally, the last span, Span 1, is set in place.

With all the spans in place, the bridge is now ready for an open timber deck to be installed by Soo Line forces.

Deck, footwalk and handrails are installed. Note the cut has been seeded and mulched in accordance with state requirements. It's starting to get green here.

Removal of Old Structure

This is the start of the removal of the old structure. The floor system was burned out and the trusses were dropped. As soon as the truss spans were dropped they were immediately pulled out of the river in accordance with requirements. Holes were drilled to shoot the pier and the results of the blasting removed.

Costs

The cost to retrieve and transport, clean and paint and set plus the scrap cost of the structure was $308,000. The estimated cost in place for new steel was $670,000 which represented quite a savings. Total cost of the structure less Soo forces work was $825,000. Removal of the old bridge and installation of the new bridge were blessed by both the Michigan and Wisconsin Departments of Natural Resources. This job went along so well that we designed one for the North Western and decided to retrieve some more spans. These are 100 foot girder spans across the Skunk River on the same line. They weigh 96 tons apiece.

More Retrieval

Here the launching girder has been started up over the spans to be retrieved. End loaders are pushing the launching truss across the flag tower. This is the lifting of the first bent girder. Here again we are using post tensioning jacks. This is the top of the launching truss during the - lift. Two hundred and twenty lineal feet of launcher were assembled to effect balancing when pulling the launcher back after each span is removed. The 100 foot deck girder was pulled across existing spans. Here again, the Hillman Rollers were used for this operation.

Hillman Rollers are at the corner of the girder in the lower left part of the slide; bridge span is rolling across existing spans on the Hillman Rollers. These rollers have a 75 ton capacity. The 100 foot spans are 10 feet deep.

The launcher is retrieved, pulling it back across the top. All but the last span had been removed. The last span was not needed for the C&NW bridge and unfortunately has since been scrapped.

A 100-foot section of the launcher weighs 500 pounds per foot or 50,000 pounds total.

The hundred foot DPG loaded and on its way to Melcher, Iowa, and eventually a new home in the C&NW bridge.

Thank you for the opportunity to present this to you.

(Applause)

Mr. Kapp: Any questions of Mr. Williams? All right, I'll turn the rostrum back to President Williams then.

President Williams: Thank you, John, and thank you, Jack. I know we all know what our stock of spare girders is, but you don't think about the ones that have been left out on the railroad by abandonment. It's a great way to save money. Thank you again, Jack.

As of 11:00 a.m. the Roadmasters have 421; B&B has 140; Associates 525 and guests 838 for a total of 1,924 and the 469 ladies for a total of 2,393. So it looks like we are doing very very well. I want you to remember that REMSA's reception is at 6:30 p.m. Tickets are available at REMSA's booth out in the lobby.

Another thing that is not on the program is that, as many of you may know, for the last three years we've been trying to get a film on maintenance of way practices in Russia. It is here; we have it, and it will be shown at 9:45 tomorrow morning.

This session is now adjourned until Wednesday morning at 8:30 a.m. Thank you, gentlemen.

WEDNESDAY MORNING

September 18, 1985

The Wednesday morning joint session was called to order at 8:30 a.m.

President Williams: I have an update on the registration as of this morning: we have 421 Roadmasters; 140 B&B; 541 Associates; 928 guests for a total of 2,030 and we have 469 ladies with a total of 2,499.

At this time I would like to thank REMSA for the wonderful reception and entertainment last night. I am sure it was enjoyed by all. Thank you, Frank Semans, and your entertainment committee.

We're going right into our session, because we have a very busy morning, and I would like to turn this over to Don Bessey to introduce our first special features. Don.

Mr. Bessey: Our first speaker this morning is John Kapp.

John graduated from Drexel University in 1968 with a Bachelor of Science in Civil Engineering. He worked as Project Engineer for the Pennsylvania Department of Transportation for ten years before joining Conrail in 1978. John has served as Proejct and Staff Engineer of Construction. Presently he is Projects Manager-Construction involved with major new construction projects. John is B&B's Special Feature Chairman this year, and he has come with a special feature — the reconstruction of the collapsed twin arch in Lake City, Pennsylvania. John.

Mr. Kapp: Thank you and good morning. It's nice to see so many bright and shining faces after REMSA's reception last night. Could we have the lights, please?

Reconstruction of Collapsed Twin Arch Culvert at Lake City, Pennsylvania

by John T. Kapp

Project Manager–Construction
Conrail, Philadelphia, Pennsylvania

On March 15, of this past year, Conrail experienced the collapse of a twin arch stone culvert that supported the two main line tracks of its Chicago to Buffalo mainline near Lake City, Pennsylvania. Rail traffic had been detoured onto a parallel road's track the previous day. In the next four months, work proceeded day and night to restore the structure and the ninety foot deep embankment that covered the twin culvert on which the track bed was founded. On July 15, service was restored to these mainline tracks despite record rainfalls during the months of June and July in the Lake City area. The construction methods employed during this four month period are the basis for this presentation.

The stone twin arch culvert that existed at milepost 103.16 on the Chicago-Buffalo mainline was constructed around 1865, with a concrete extension added on the south or inlet end in 1905. The culvert was used to allow Elk Creek to flow from the hills south of the site northward to Lake Erie draining some 66,000 acres. The twin culverts were each forty feet wide, with an inside height of thirty-one feet, and three hundred fifteen feet in length. When the collapse occurred on March 15, one hundred and seventeen feet of the original stone arch were affected. The remaining portion of the stone arch showed no damage and was subsequently inspected by a consultant engineer to assure its structural soundness.

On March 16, Conrail began removing the ninety feet of fill that covered the culvert. Water began to flood the back area of the inlet side of the culvert as the collapse blocked both of the arch culverts. Homes and highways were inundated with water. Bulldozers and backhoes worked day and night to remove the soil that blocked the culvert. At 1 p.m. on March 20 the blockage was removed and the water began to flow through the culvert.

Work continued to excavate the remaining portion of the 225,000 cubic yards of fill that had to be removed to allow an inspection of the culvert. Slag was brought onto the jobsite to stabilize access roadways. Core borings were taken along the inside and outside of the culvert down to an elevation below the bottom of all footings to determine the cause of the arch collapse. A fault area at the inlet end beneath the floor and center pier foundation was discovered that allowed undermining to occur. The center pier area settled, thereby causing a failure of the arch structure itself. All unsound portions of the stone arch had to be removed. Elk Creek was diverted through the east arch using a stone and sandbag dike.

On April 10, twin ten foot diameter pipes were installed throughout the entire length of the west tube in forty foot sections to facilitate the new center pier foundation construction. Rock anchors were drilled into the underlying shale on both sides of the pipe. Wire rope was then used between the anchors and over the top of both ten foot diameter pipes. Elk Creek was diverted through the 10 foot pipes on April 12.

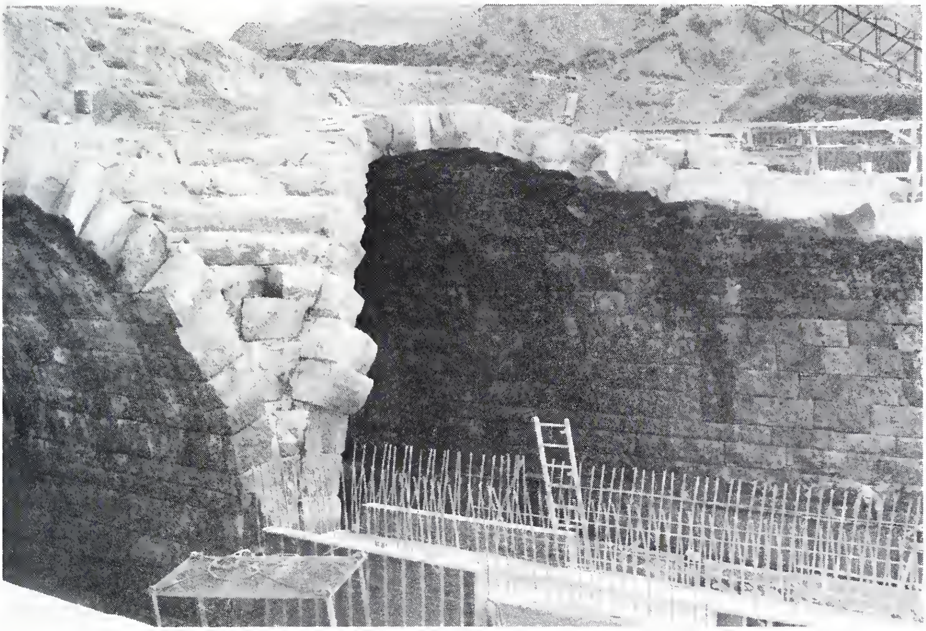
As excavation for the new center pier foundation progressed, past efforts to control erosion, as shown by the reinforced concrete, in the center pier foundation area were uncovered as were the voids in the fault area. A new foundation was poured in two separate pours. The first pour completed on April 16 acted as a leveling course varying from one to four feet in thickness. The second foundation pour was five feet thick and incorporated reinforcing steel for the future center pier wall. Concurrently with the center pier foundation and wall construction, new backwalls were being constructed outside the east and west face of each stone culvert. An area was excavated behind the outside faces of the culvert to a depth of ten feet below the springline elevation, the elevation where the curved section of the arch begins. A stone base was placed and compacted upon which forms were set. Concrete was placed in the forms that incorporated number seven reinforcing at six inch vertical centers going up the two faces of the new backwall. The top elevation of the backwall was raised in two stages to allow continuous reinforced concrete to extend up and over all remaining sections of sound stone in the original outside culvert walls.

During the center pier foundation construction, a plan was developed to drill through the inside floor of the stone culvert adjacent to all foundation areas, including wingwalls, and along the inlet or south face of the culvert. The two inch diameter holes were then pressure grouted to assure that any fault areas not uncovered in the new center pier foundation excavation would be filled. Holes were drilled on twenty foot centers to a depth of 10-20 feet below existing foundations, except where core borings had discovered problem areas or where excessive grout was used to fill previously completed work. The end result was 154 holes throughout the structure that used 370 bags of cement to fill.

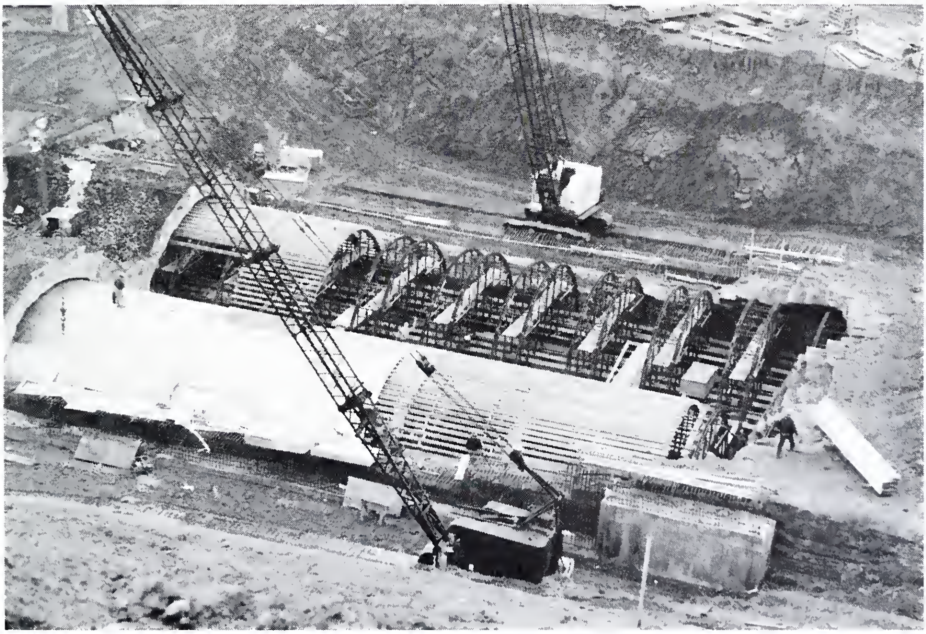
The center pier wall was formed and constructed up to the elevation of the spring line. The walls were placed in two separate lifts by using a pouring sequence that was utilized throughout the construction of the arch and buttress sections. Alternate sections would be poured on one day with the adjoining sections being poured on a subsequent day. In the case of the slide shown, sections one and three were poured, followed by the sections two and four.

While foundation and backwall work were proceeding, new protection encasements were being formed and placed inside the culverts. These encasements for the arch's foundations extended over and down the face of the existing stone walkway to form a barrier against future erosion as well as form a level surface upon which the baseplate for the arch falsework could bear uniform weight distribution.

During the construction of the backwalls and center pier foundation, a design was being developed for the arch form support system. The main considerations of the various designs that were proposed were: (1) time for delivery of the support system, (2) ease and speed of construction once all the support components arrived on the job site, (3) the system's cost, and



Existing stone twin arch culvert with new middle pier foundation in place.



Arch formwork under construction.

(4) possible damage that would be sustained by the system in event of flooding.

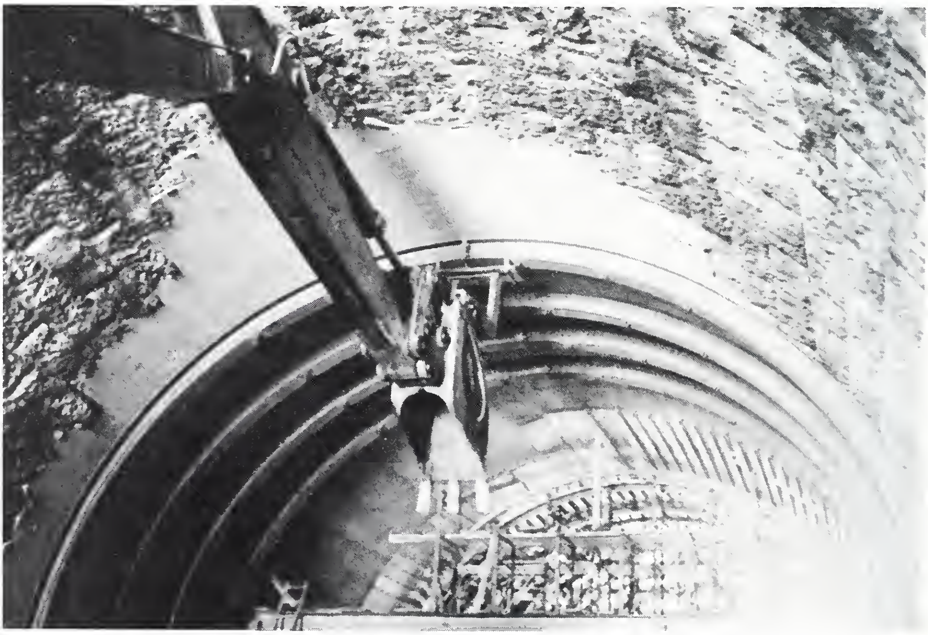
The erection of the system employed a series of curved C6x8.2 steel double channels that were supported by W36x150 beams, tubular columns and jacks to support the formwork began April 25. The channels were fabricated with the exact radius of the existing tone structure while allowing for the additional components of the formwork that would be placed against the top or outside of the curved members. The channels were used in sets of two, four feet apart. the sets were constructed on eight foot centers. The support for the channels was provided by scaffolding with screw jacks, welded connections with the W36 beams, and anchored wall connections. The six inch square tubular columns were placed over jacks that bore upon the newly constructed sidewalks. Additional side bracing for the channel was provided by mini-jacks.

On top of the curved channels, 6½ inch aluminum joists were fastened using clips that clamped onto the circular sections. Wood blocking was placed between the aluminum beams for additional support. The aluminum beams had a wood nailer on their top side to allow nailing of the double layer of plywood that would actually form the underside of the new arch. Sheets of plywood were placed so that the plywood edges were offset between the two layers of the plywood form. The work continued around the clock.

Reinforcing steel for the curved arches was fabricated with the exact arch curvature in the transverse number seven bars that were to be placed at six inch centers. The bars were then formed into separate upper and lower mats at a staging area on the jobsite and placed on the arch formwork by crane.

Buttress sections were formed over the newly constructed backwalls that carried the transverse reinforcing steel from the backwalls to the arch section. This formed a continuous steel and concrete composite section throughout the new structure. The varying elevations of the stone backwall required a different reinforcing steel pattern at each step in the backwall.

The center pier of the arch was poured in two separate pours for each of the four sections beginning on May 13. Alternate sections of the lower portion would be poured one day with the lower portions of the remaining sections being poured the following day. After a day for



Structural steel inserts being placed inside culvert.

placing new bulkheads and the attaining of proper concrete strength, the upper sections of the center pier were placed in the same sequence on the following two days. To balance the lateral weight against the arch formwork, buttress sections were poured on the same day as the upper section of the center pier. To illustrate, when sections one and three of the upper center pier were poured, buttress sections one east, one west, three east and three west were also poured that same day.

Finally, on May 18 the first set of arch pours began. Holes were cut in the tops of forms to insure adequate vibration. Wood posts (4x4's) were used to check reinforcing steel depth and removed during the pours. Reinforcing steel placement continued on alternate pours. Special reinforcing details were required where the concrete met the existing stone arch. On May 20th the final arch pour was completed utilizing additional cement in the concrete and a pozzolith additive that improved the workability of the concrete and held the promise of higher strengths. This would allow for a quicker removal of the supporting formwork. Compressive strength of the concrete averaged over 4,000 pounds per square inch after only four days. Form removal began on May 23 with the scaffolding jacks being released first in the center throughout the concrete arch's length. Jacks were then released in pairs working outward from the center of each arch.

The form removal time was of particular importance as structural steel inserts had been designed and fabricated for placement inside the culverts in the transition area between the new concrete and old stone sections. The W12x72 members used to line the interior of both arches were spaced on five foot centers using a special steelfork fabricated on the backhoe that had been fabricated on the jobsite. Spacing rods and reinforcing steel were placed between the inserts and stay in place five gauge forms bolted to the flange of the sets. Concrete was pumped into the formwork and vibrated with conventional equipment until the top quadrant of the arch was reached. In a separate last pour, external vibrators were bolted to the steel beams and used to consolidate the concrete.

Once the steel members were in place, the fill operation commenced on May 29th. The backwalls had been previously backfilled prior to the arch pours to provide lateral pressure against the backwalls that would offset the out-

Earth tractors with outriggers positioning track panel.

ward lateral pressure created by the dead load of the arch concrete itself. A self-contained mat of Bentonite was placed on top of the concrete center pier, arches, buttresses, and down the backwall as waterproofing. Both the new concrete and the concrete extension built in 1905 were covered. The center pier area was then filled with sand and gravel and covered with filter fabric to provide drainage. Outlet pipes through the existing concrete extension had been cleaned previously.

On-site materials were used up to the elevation of the top of the parapet walls. Three feet of sand was placed over this to allow for drainage through the embankment of water that might be trapped during construction.

From the top of the sand layer, the embankment proceeded upward utilizing on-site and borrow materials. Modern equipment capable of spreading and compacting the soil simultaneously were utilized.

Meanwhile, back at the arch, other improvements were being completed to further guard against future erosion. A stone floor had been built at some previous time, but only partially covered the length of the culverts. A new concrete floor was placed that extended in both directions from the stone floor to create a continuous floor throughout the arches.

Apron walls were constructed bearing on rock on both the inlet and outlet ends of the floor. An extension to the center pier was added on both the inlet and outlet ends. A steel "bullnose" was added on the inlet side to guard against further deterioration of the 1905 concrete extension. Foundation encasements were poured throughout the structure. Wingwalls were repaired.

Finally, five sets of steel inserts identical to those used in the transition area between concrete and stone were placed inside the 1905 concrete extension at five foot centers. Again, reinforcing, lagging, and finally concrete were placed between the steel members. By now the borrow material for the embankment was being delivered over the top along the railroad right of way. A D-9 dozer was used to pull a D-6 dozer over the slopes to walk-in the slopes. Compaction was being achieved while the top of the embankment was being reached.

On July 15 at 8 a.m., five earth tractors equipped with outriggers were positioned to lift the first of two 700 foot panels that had been built atop the tracks to the west of the project site. These panels along with smaller panels located to the east of the project site were placed on the ballast pad that had been placed during the early hours of July 15. Two and two-tenths inches of rain in the morning hours of the 15th hampered but did not stop the work. The track panels were bolted together, lined and tamped until the passage of the first train at 6 p.m. on July 15th. In subsequent days, the bars were removed and the rail welded together as the track was brought up to timetable speed. Seeding of the slopes along with the placement of erosion protection mats was completed. Bank protection for Elk Creek was placed.

The project which began with the collapse of the twin arches on March 15 had traffic over it on July 15 with all restoration work on both the arch and the surrounding Elk Creek completed by August 7th. The total cost of the project was over $7,000,000 and used 5,900 cubic yards of concrete, 310,000 pounds of reinforcing steel and 200,000 cubic yards of earth borrow material for its completion.

Thank you.

Mr. Bessey: Any questions? All I can say, John, is "Wow!" John, now I can see why it was so difficult to get you on the phone this past summer when I wanted to do B&B business with you, and I also understand why Kathleen had to go to the seashore by herself. Thank you very much. That was very interesting.

Our next speaker is Mr. Stewart Currie of British Rail. Last year Mr. Currie furnished a film to me that was presented at the B&B and Roadmasters conference in Chicago called "125". It was about building a track system for 125 miles per hour. Mr. Currie couldn't come to Chicago last year to present the film, because his boss wouldn't let him. Well, this year he's the boss, so he's here. After studying engineering at Herricot-Watt College in Edinburgh, Scotland, Mr. Currie served in the Army Transportation Branch of the Royal Engineers. He then joined British Rail, being associated particularly with track and bridge design works before becoming a District Engineer. Thereafter he became Chief Civil Engineer, Scottish Region, followed by a two-year period as Project Manager of the Channel Tunnel. On the cancellation of this project, he became Deputy Director and then Director of Civil Engineering, British Rail, which is his present position. Mr. Currie.

Brittania Bridge

by D. Stewart Currie

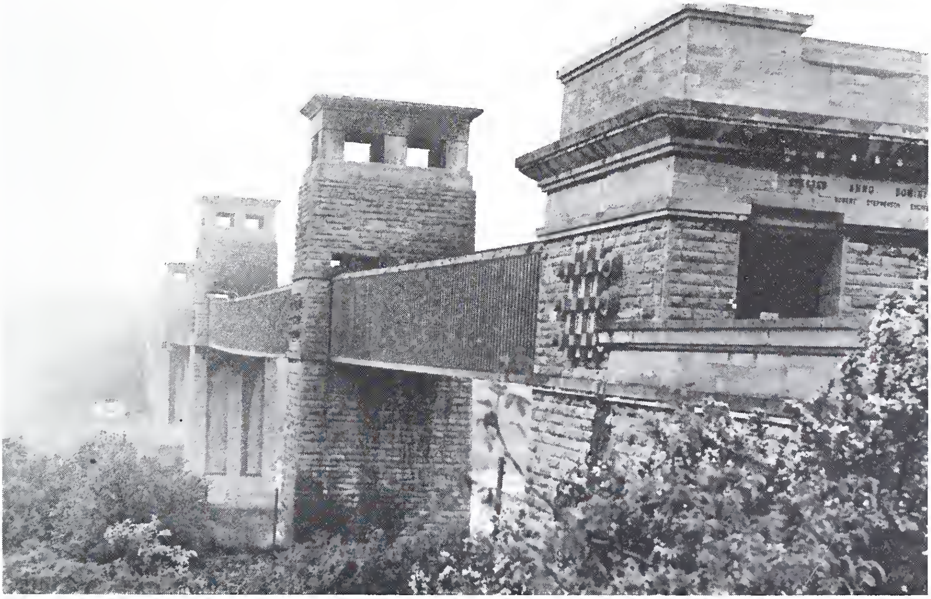
Director of Civil Engineering
British Railways Board, London, England

Ladies and gentlemen, I'm very pleased to have the opportunity of speaking here today on Brittania Bridge. It appears the theme this morning is engineering disasters so we can continue with this particular bridge now. The mishap occurred about 15 years ago, but I think it is still of interest, because it was a rather unique occasion as far as British Railway was concerned. When I first received a telephone call to say that the bridge was on fire I was more than a little puzzled. It's a wrought iron structure with masonry piers, and I just couldn't work out why or how it possibly could be on fire. The explanation was quite simple, but we'll come to that a little later. It's different from the United States I think in that we don't have any timber bridges carrying railways in the United Kingdom at all. Unlike America where you have a lot of timber bridges and possibly fires are more common than we have. However, I would like to show a few slides to start with to give you an idea of the bridge, and then we'll talk about it in more detail afterwards.

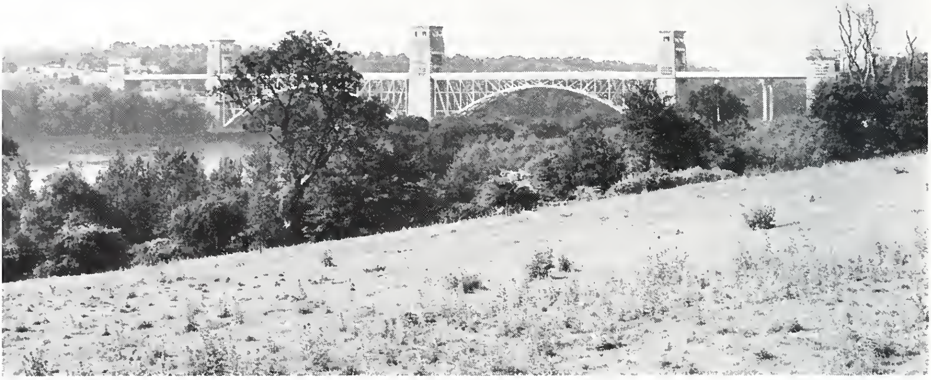
The Brittania Bridge

The Brittania Bridge has, since 1847, provided a rail link between North Wales and the Isle of Anglesey. The bridge spans the Menai Straits, a tidal stretch of water used principally by coastal shipping and pleasure craft. The importance of this railway line centers around the port of Holyhead which is one of the main seaports for traffic between the United Kingdom and Ireland with ships sailing between Holyhead and Dublin. The port is some 264 miles from London and, in the late 1960's, a new container terminal was constructed there to accommodate the growing business in rail-borne container traffic to and from Ireland.

On the night of May 23rd, 1970, two boys were birdnesting on the bridge and set fire to some paper which ignited the timber roof of the



Original bridge after the fire showing damaged wrought iron box girders.



Brittania Bridge reconstructed for rail traffic.

structure. The resulting fire damaged the bridge beyond repair and necessitated its complete reconstruction. The cutting of this rail link to the isle of Anglesey meant that the recently completed container terminal was put out of action, and the only access to the island was by road over the Menai Suspension Bridge, designed and built by Thomas Telford in 1826. This bridge was subject to loading restriction, and was inadequate for normal road traffic without the imposition of additional traffic diverted from the railway. The situation was further complicated by ornamental arches on the bridge approaches which restricted the size of road vehicles using the bridge.

As a result of the fire, several diesel locomotives and passenger coaches were cut off in Anglesey. Arrangements were therefore made to load the locomotives on ships to be returned to the mainland. The coaches were lifted from their bogies and taken by road over the suspension bridge to be put back into service.

The original bridge was designed and built in 1847 by the Railway Engineer Robert Stephenson. It consisted of two rectangular wrought iron tubes 30 feet deep and 15 feet wide, each of which carried one track internally. The structure was of continuous construction with two spans each of 450 feet giving a minimum headroom for shipping above high water level of 105 feet. As a result of the fire the wrought iron tubes cracked over the piers and the two main spans had sags of 28 inches and 17 inches respectively.

Problems had been experienced shortly after the original structure had been completed with water lying on the top of the tubes, and as a result a timber pitched roof had been built on top. It was this timber structure which caught fire on May 23 and which damaged the bridge irreparably.

One of the first problems after the fire was how to remove the damaged structure prior to reconstruction. When Stephenson had constructed the original bridge, he built the tubes on shore and floated them out to the already prepared piers. The tubes were jacked up step by step until they were in position. They were then plated and rivetted together to form a continuous wrought iron structure carried over the piers. After the fire, various alternatives were considered for the removal of the tubes, but because of their damaged condition it was not possible to lower them back down to sea level. It was decided therefore that an arch structure be built below the old bridge which could act firstly as the scaffolding for the removal of the remains and secondly become the new bridge. This had the advantage of retaining the original stone piers enabling the reconstruction to proceed quickly. The approved design for reconstruction would provide clear spans of 440 feet with headroom over the shipping channel of 90 feet. The arch had to be constructed without the use of centering in the straits by cantilevering out from the two mainland towers and similarly by achieving a balance about the center tower.

Additionally, it was agreed that a roadway would be constructed on the new bridge. Steel was chosen as the most suitable material for the new arches and large units of these arches were constructed at a nearby harbor and floated out on barges before being raised into position.

Once the arches were completed, the load of the old structure was transferred to them, and the original wrought iron bridge was cut into sections and removed. The total weight of wrought iron in the Stephenson tubes was 10,500 tons and this can be compared with the steel in the new structure which weighs 9,400 tons. The structure was designed to carry the International Union of Railways standard railway live loading with appropriate allowances for impact and lurching, and there was no necessity to limit train speeds on the bridge because of the structural design. However, a speed limitation of 40 miles per hour had to be permanently enforced because of the sharp radii of the approach curves. At the design stage the live load of the road deck was also allowed for, and this meets the requirements for the heaviest loading permitted in the United Kingdom.

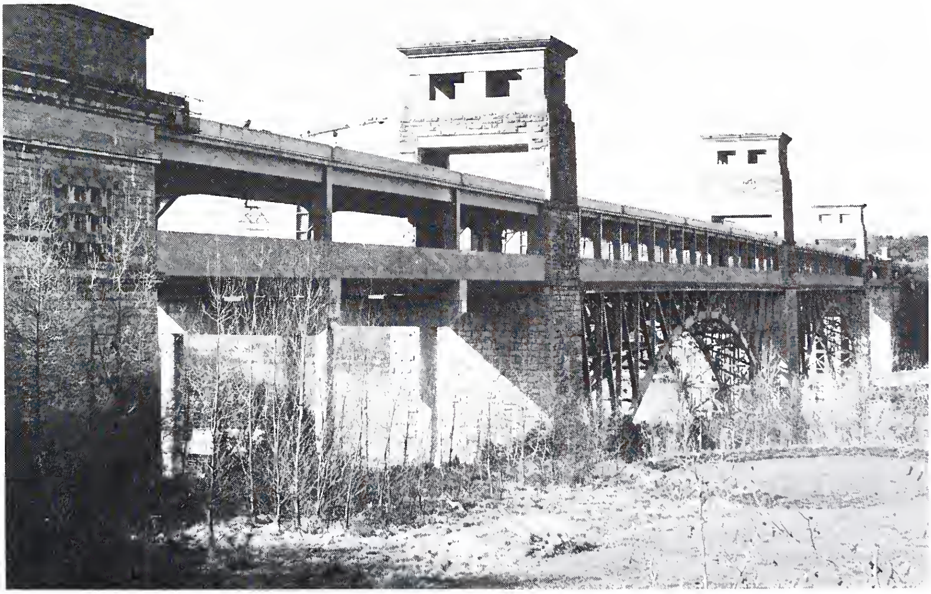
The foundations for the arch springings were designed to transmit the thrust from the arches to bedrock by the most direct paths available. Heavily reinforced concrete foundation blocks were cast against the bases of the existing masonry towers and carried down to solid rock.

The protection of the steelwork was particularly important taking into account the proximity of the sea, the influence of high winds, and the relative inaccessibility of parts of the structure from the maintenance gangways. All steelwork was cleaned by grit blasting, followed by aluminum spraying, and the application of two coats of priming paint and two coats of micaceous oxide paint.

The cost of the reconstruction of the bridge for rail traffic in 1973, including parapets and walkways, was approximately 8 million dollars, with an additional cost of 6.5 million dollars for the road which was later (in 1980) completed above the railway track.

Mr. Bessey: Do you have any questions of Mr. Currie? I think it was a remarkable presentation and on behalf of the two Associations we certainly thank you for being here and sharing your catastrophe with us. President Williams.

President Williams: At this time I would like to mention the special subject cards that you'll find in the seats around you. We would like you to fill these cards out. It's the only way that our two organizations are going to be able to continue to present special subjects and special features that will be of interest to everyone. At this time I will turn the rostrum over the President Staplin. Dave.



Bridge with new road deck superimposed on rail deck.

President Staplin: Thank you, Jim. It's nice to see so many faces out there this morning after the REMSA reception last night.

Because of the presentation of the next feature, we're going to have to move right along, and without further ado I'll turn this over to Ken Welch who will highlight the next speaker. Ken.

Mr. Welch: First of all, I want to thank the two previous speakers. I think we've had two fantastic presentations this morning, and as I say, we're going to have another one.

I know many of you out there know Frank Richter personally. However I'm sure some of you don't. You undoubtedly know him through *Progressive Railroading* as Frank is the publisher. He has long been a friend of Roadmaster, B&B, AREA, and REMSA, and all railroaders in North America in general. We've been trying to get this film from Russia for three years, and I think Frank may have a few words about how he acquired the film as he's been working a long time trying to get it. Frank.

Maintenance of Way Practices in Russia

by **Frank Richter**

Publisher, Progressive Railroading

Mr. Richter: Thank you very much, Ken. I'm more accustomed to being on the other side where you fellows are than up here, but it's really a pleasure to be able to see all you fellows out there, some of whom I've been trying to say "hello" to because you've helped us out so much in the past, and maybe this will be a small way of repaying you.

I've seen this film twice. The first time was when the International Railway Congress was held in Spain three years ago, and the second time was when it was held in Brussels in May. It has English dialogue, so that you don't have to worry about struggling through the Russian. It portrays the maintenance of way practices of the Russian railways in an up-to-date fashion I would say, because the second version I saw was somewhat different from the first version, so this is the second version.

Traveling in Russia and trying to observe what you're going to see is very, very difficult, because they do have their clearance problems. A group of us went over there about six years ago when they had an exposition. We saw much of the machinery there in an outside exhibit and an inside exhibit, very much like the one that we have here.

(Whereupon there was the film presentation "Maintenance of Way Practices in Russia")

President Staplin: I'm sure you all agree that that was worth waiting for. We appreciate Frank Richter's efforts to secure it. At this time I would like to turn the rostrum back over to Jim Williams.

Frank Richter

President Williams: Thank you, Dave. This concludes our joint session for the conference. In ten minutes we'd like the B&B to meet down in Room 217N on the second level. The Roadmasters will meet here. Again I would like to remind all of you about the special subjects cards. We want everyone to get involved in our associations, and fill these out and turn them in at the registration desk. This session is now adjourned.

WEDNESDAY MORNING

10:30 a.m.

President Williams: Will all those present please be seated. I would like to call this first session of the B&B Association to order.

I would now like to introduce those at the head table. On my right: Director W.P. Cunningham, Utilities Engineer, Missouri Pacific, St. Louis, Missouri.

Director J.H. Smith, Engineer Buildings and Facilities, Illinois Central Gulf, Chicago, Illinois.

Director J.J. Horney, System B&B Supervisor, Union Pacific, Omaha, Nebraska.

Senior Vice President, D.A. Bessey, retired Assistant Chief Engineer Structures, Milwaukee Road, now Senior Architect, Envirodyne Engineers, Chicago, Illinois.

On my left:

Director B.T. Burns, Steel Bridge Inspector, Santa Fe, Topeka, Kansas.

Director D.R. Ladner, Assistant Engineer, Chicago and North Western Transportation Company, Boone, Iowa.

Junior Vice President D.J. Lewis, Senior Structural Designer, Illinois Central Gulf, Chicago, Illinois.

Junior Vice President, John Kapp, Project Manager Construction, Conrail, Philadelphia.

You may now applaud.

The By-Laws of our Association dictate that I now present a report of the general condition of our association.

Our membership has stayed farily constant over the last year and our finances have stayed near the break-even point. Both of these items will be noted in the Secretary's and the Treasurer's reports which will be given a little later in this session.

As information to the membership, the Executive Committee has voted to have our office staff, with the help of the membership, handle the advertising for the *Proceedings*. If we can keep our advertising at its present level, it will mean a 35 percent increase in our income which should help keep us in the black. I would like you to know that I stated "with the help of the membership", because it will be up to you and me and all of us to make this new system work. I would also like to ask your help to further improve the Association's situation by, first, paying your dues promptly; second, urge all of your fellow workers and associates who are eligible for membership, to join the Association.

Before I go on, for those of you who haven't noticed, we have a new office assistant, Brenda Gilmore. Brenda replaced Joyce Grier in May when Joyce decided that it would be more fun to be retired and playing golf than working. So we welcome Brenda and wish Joyce a long and happy retirement.

Now, for a much more pleasant task, I want to ask Jim Budzileni, Senior Structural Designer, Illinois Central Gulf, and our immediate past president, to call our other past presidents in attendance today to come forward and be recognized. Jim.

Mr. Budzileni: I guess the one thing nice about being past president is you can't fire me because you already did! The gentlemen of the American Railway Bridge and Building Association owes many thanks to our past presidents who have served this Association. It has been through their constant contact with our present officers that has made this Association what it is today. It gives me a great deal of pleasure to recognize the past presidents of this organization at this conference. As I call their names I ask that they stand and remain standing until all have been introduced.

N.D. Bryant, Burlington Northern, President 1972-1973;

J.R. Williams, Alfred Benesch and Company, President 1975-1976;

W.C. Sturm, Elgin, Joliet and Eastern Railway, President 1978-1979;

J.C. Chambers, Missouri Pacific, retired, President 1980-1981;

W.H. Huffman, Chicago and North Western, President 1957-1958.

Let's give these fellows a good round of applause.

(Applause)

President Williams: Thank you, Jim. It is a pleasure to have you all with us today. We owe a great deal to all of you.

Mr. Budzileni is also Chairman of the Nominating Committee and I call on him at this time to present the slate of candidates recommended by the Committee for consideration.

Mr. Budzileni: Thank you again, Jim. The Nominating Committee respectfully submits for nomination the following slate of officers.

President — D.A. Bessey, Assistant Chief Engineer Structures, Retired, Chicago Milwaukee, St. Paul & Pacific, now Senior Architect, Envirodyne Engineers, Chicago, Illinois.

Senior Vice President — John T. Kapp, Project Manager Construction — Design and Construction, Conrail, Philadelphia, Pennsylvania.

Junior Vice President — Donald L. Lewis, Senior Structural Designer, Illinois Central Gulf Railroad, Chicago, Illinois.

Junior Vice President — R.A. Tallent, Project Engineer Structures, Southern Railway, Atlanta, Georgia.

Directors for term ending in 1986 — B.T. Burns, Steel Bridge Inspector, AT&SF, Topeka, Kansas; J.J. Horney, Bridge & Building Supervisor, Union Pacific Railroad, Omaha, Nebraska; W.J. Semioli, Associate Publisher/ Editor, Railway Track & Structures, Chicago, Illinois.

Directors for term ending in 1987 — D.W. Brookings, Engineer of Track, Kansas City Southern, Shreveport, Louisiana; W.P. Cunningham, Utilities Engineer, Missouir Pacific, St. Louis, Missouri; J.H. Smith, Engineer Buildings and Facilities, Illinois Central Gulf, Chicago, Illinois.

Directors for term ending in 1988 — D.L. Steele, Bridge & Building Supervisor, Union Pacific System, Omaha, Nebraska; M.C. Walbrun, Manager Engineering Design, Amtrak, Philadelphia, Pennsylvania; E. Bond, Chief Engineer, Bridges & Structures, Norfolk & Western Railway, Roanoke, Virginia.

Treasurer — Paul Saletnick, Engineer Buildings, Chicago Northwestern Transportation Company, Chicago, Illinois.

President Williams: Thank you, Jim. You have heard the slate of nominess recommended by the Nominating Committee. Since there were no other nominations received, according to Article 10 of the By-Laws of the Association, I will accept a motion that the slate submitted by the Nominating Committee be elected.

Member: So moved.

President Williams: Do I hear a second?

Member: I second.

President Williams: The motion was made and seconded that the slate of candidates recommended by the Nominating Committee be elected to the offices specified.

All in favor, signify by saying "Aye".

Members: Aye.

President Williams: Opposed?

(No response)

President Williams: The "Ayes" have it. I therefore, declare these officers duly elected. Will all the new officers and directors elect please stand and be recognized? Thank you, gentlemen.

We will now proceed with our business session. Now I would like to introduce our secretary and the one who does all of the behind the scene work of the Association and gets little credit, Mrs. Pat Weissmann, who will present the Secretary's Report.

SECRETARY'S REPORT

September 1, 1984 through August 31, 1985

Total members, September 1, 1984			736
New members since September 1, 1984			43
			779
Less: Deceased —	Associate	2	
	Honorary	1	
	Life	6	
Dropped —	Active	38	
	Associate	12	59
Total members, August 31, 1985			720

	August 31		Increase
	1985	1984	(Decrease)
Active	447	465	(18)
Associate	87	91	(4)
Life	177	170	7
Honorary	9	10	(1)
	720	736	(16)

Dues paid as follows:

	Active	Associate
1986	120	32
1985	267	44
1984	60	11
	447	87

534 members pay dues.

September 3, 1985

President Williams: Thank you, Pat. Paul Saletnik, our Treasurer, cannot be here, and Wally Sturm will present the Treasurer's Report.

TREASURER'S REPORT
September 1, 1984 through August 31, 1985

Cash on hand, August 31, 1984		$ 9,889.55
Receipts		
Dues	$11,185.60	
Advertising	13,945.00	
Conference	2,435.96	
Miscellaneous	514.01	28,080.57
		37,970.12
Disbursements		
Salaries	$ 7,515.10	
Payroll Taxes	599.91	
Office Expense	1,348.81	
Printing	1,131.93	
Postage	1,498.06	
Supplies	360.00	
Advertising	5,881.75	
Conference	352.70	
Proceedings	15,404.42	
Board Meetings	183.32	
Miscellaneous	316.31	34,592.31
Cash on hand, August 31, 1985		$ 3,377.81

President Williams: Thank you, Wally. Jack Williams, will you please present the Auditor's Report.

AUDIT COMMITTEE REPORT

**TO: MEMBERS OF THE AMERICAN RAILWAY
BRIDGE AND BUILDING ASSOCIATION**

Gentlemen:

The undersigned have examined the books of the Secretary and report of the Treasurer for the period September 1, 1984 through August 31, 1985 and have found them to be correct as of August 31, 1985.

Respectfully submitted,

J.R. Iwinski, Chairman
J.R. Williams
W.C. Sturm

President Williams: Thank you, Jack. Now Bill Cunningham will present the Necrology Report. Bill.

NECROLOGY REPORT

September 3, 1985

To the President and Members of the American Railway Bridge and Building Association:

It is with grief and regret that we report the known loss of nine (9) members through death during the past year. It is possible that other members have passed away during the year of whom we have no information. If you know of any, please report their names to the Secretary. The following have been reported since our last Annual Conference in September 1984:

ASSOCIATE MEMBERS	TITLE-RAILROAD-LOCATION	JOINED	DECEASED
L. Klosk	President RR Mtnc. Corp. Bronx, NY	1959	1985
A.G. Mortimer	Mgr. Tech. Services Lakewood, OH	1980	1985
HONORARY MEMBER			
G.W. Benson	Div. Engr. C. of GA Rwy. Macon, GA	1940	1985
LIFE MEMBERS			
W.H. Bunge	Asst. Engr. Missouri Pacific RR Houston, TX	1941	1985
W.A. Enstrom	GM-RR Prod. Div. Pettibone Mulliken Corp. Chicago, IL	1956	1985
R.L. Fox	Proc. Engr. Southern RR Dry Fork, VA	1935	1985
W.F. Martens	Gen. Frmn. B&B ATSF RR Kaneohi, HI	1924	1984
C.A. Patterson	B&B Supv. TP&W RR East Peoria, IL	1955	1982
W.L. Taylor	B&B Supv. Southern Rwy. Phil Campbell, AL	1950	1984

Respectfully submitted,

W.P. Cunningham
Chairman

President Williams: Thank you, Bill. Are there any questions regarding the reports as presented by the Secretary, Treasurer, Auditing Committee or Necrology Committee? If there are none, I request a motion from the floor that these reports be approved as presented.

Member: So moved.

President Williams: Is there a second?

Member: I second.

President Williams: The motion has been made and seconded. All in favor signify by saying "Aye".

Members: Aye.

President Williams: Opposed?

(No response)

President Williams: The motion is carried, and the reports are approved.

Now, let's move along to our first special subject of which Mr. Ladner is the sponsor. Don.

Mr. Ladner: Thank you, President Williams. It says here on my name tag that I live in Boone, Iowa. Nothing gets more snickers than to say that you live in Boone, Iowa, but I think that few people really realize the significance Iowa has in railroading and our heritage. Iowa is the host of the National Hobo Convention annually in Britt and it reminds me of a story about one of the participants at the convention this season. It seems that a hobo was on his way to the convention, and it was getting late, and he was looking for a hot meal and a place to sleep, and he approached a home and rang the doorbell. A woman answered the door and he told her he was on his way to the convention and was looking for some odd jobs he could do to earn a hot meal and a place to sleep. So the woman told him she had been asking her husband for about three weeks to paint the porch out in back, and told him that if he painted the porch she would feed him and give him a place to sleep that night. So she handed him a bucket of paint and a brush, and he went out back. About an hour later he came back and rang the doorbell again, and the woman asked what he needed and he said that he needed some more paint. And she couldn't understand that and gave him kind of a puzzled look, and he said that the green wasn't covering over the red worth a darn. And she gave him an even funnier look and he said "Oh by the way, lady, that ain't a Porsche out there, it's a Ferrari." (Laughter)

Our first presentation for this B&B session is a Special Subject Report dealing with repairs to concrete bridge members. The presentation will be given by Ken Bruestle of the Burlington Northern. Ken is the Regional Bridge Engineer for the Billings Region. He received his Bachelor's Degree in Civil Engineering from the University of Minnesota and joined the Great Northern Railroad in 1963 in St. Paul. He has served in various bridge design and maintenance positions between 1963 and 1977. In 1977 he became project engineer and supervised construction of some 50 bridge projects between 1977 and 1982. He assumed his present position in Billings, Montana, in 1982, and he is a registered professional engineer in twelve states. He is a member of AREA and ASCE. His current assignment deals with replacement of a 95-year old bridge over the Flat Head River near Glacier National Park. Without further ado, I'd like to present Ken Bruestle of the Burlington Northern.

SPECIAL SUBJECT NO. 1

Repair of Damaged Concrete Bridge Members

Chairman: K.E. Bruestle, Br. Engr., Billings Reg., BN, Billings, MT

Committee: N.D. Bryant, Asst. Chf. Engr./Mtce. Str., BN, Overland Park, KS
T.E. Kuhn, Br. Constr. Engr., MP, St. Louis, MO
D.J. Lewis, Sr. Str. Dsgnr., ICG, Chicago, IL
R.W. Emmerich, Mgr. of Engrg., Osmose Wood Pres., Madison, WI

Scope of Problem

The study in conjunction with this report revealed that the railroad industry today is using a variety of techniques to repair damaged concrete members. In many instances, more than one procedure must be employed. Most repair methods work best on a particular type of damage, such as cracks or spalls. Where extensive damage exists, several repair methods must be used to do the job. The amount of available track time can have an influence on the techniques used, and often is the governing factor.

This report will attempt to cover work required due to natural occurrences, such as freeze-thaw problems and increased tonnage, plus some examples of catastrophic events and how they were handled.

Encasement

The major causes of damage to concrete are live loads, particularly those increased loads for which the structure was not designed, and freeze-thaw cycles. Cold weather may not have much of an effect on sound concrete but certain-

Encasement

ly magnifies any slight imperfections that may exist. Poor detailing and reactive aggregate will greatly accelerate the damage caused by this annual process.

One frequently used repair procedure is encasement. In the past this method was used extensively with mixed results. Many encasements were made over cracked piers with little or no attention given to the cracks. The long term effects were predictable. An encasement properly done can greatly increase the strength and life expectancy of a concrete bridge pier.

In any repair work, the cracked, spalled, and otherwise unsound concrete must be removed to maximize the results of that work. Usually the visibly unsound concrete can be removed with a chipping tool. The tool must be sized for the job. Too large a unit can result in damage to the surrounding concrete.

After removal of the poor concrete the area should be sandblasted or flushed with a high-pressure water jet to remove any particles that have been broken but not dislodged. Special attention must be given to the pier top to seal all existing cracks and reinforce the bearing areas. Once this phase is complete, the rest of the pier can be jacketed. Hopefully, resulting in a practical and good-looking solution to what was a serious concrete problem.

In encasements of this type, the foundations should be analyzed for the increased dead load. Piling may have to be driven to support the new concrete.

Shotcreting

A repair procedure similar to encasement is shotcreting. Shotcreting is employed where the concrete is basically sound, but surficial damage has progressed to the point where reinforcing steel is exposed or the structure is otherwise threatened, as in a unreinforced pier.

In this process, the unsound concrete is removed as described earlier, and a welded wire fabric is placed to reinforce the shotcrete. The surface is then wetted and allowed to damp dry just before the shotcrete is applied. Then the cement grout-type material is shot on in a series of passes to build up the desired thickness.

One requirement of preparing the area to be shotcreted is to remove any shape that will entrap rebounding materials. If they don't adhere when they hit, the materials probably won't stick on the rebound either. A nose plate, for example, may cause some problems.

Shotcreting

The surface is mortared and hand troweled for a smooth finish and after drying will look like a Portland cement concrete job. Usually shotcreting and encasements can be done under traffic.

Pressure Injection

Another repair technique that is widely used by the railroad industry is pressure injection of chemicals. This technique is particularly suited to filling cracks in concrete to prevent the entrance of water, thus avoiding the detrimental freeze-thaw cycle. The injected material then also bonds the cracked elements together upon curing.

The first step after a candidate is found, is to determine the extent of the cracking. This is accomplished by extracting a core sample. The core is examined to determine that the cracking does go beyond the surface and that injection repairs are indeed required. The crack network is then flushed with warm water to remove dirt and other obstructions.

The surfaces to be worked on are sandblasted. Injection ports are driven into place and the cracks are caulked on the outside. The two chemical components are put on line and combined in the pumping apparatus.

The injection process starts at the lowest port, where the pressure line is attached, and epoxy is pumped until it is forced out at a higher port. At this point, the higher port is plugged and the pumping continued until all ports are plugged and, evidently, all cracks are filled. When the epoxy has hardened, the protruding injection ports are removed and ground smooth. Note that with all cracks surface-sealed one really can't know for sure that all of the cracks have, in fact, been penetrated by the pressure-injected chemicals. Therefore, it is advisable to take a representative test core again after the repairs are completed to determine if penetration has been achieved. If the work is contracted, this glued core is then the owner's proof that the repairs have been made.

Curing of the injected materials is not adverse-

Injecting epoxy

Typical epoxy repair job

ly affected by traffic, thus allowing the work to be performed without disrupting operations. The appearances of this procedure are not always pretty, but the results have been very good. One railroad recently repaired a masonry pier by epoxy injection and polymer concrete replacement of missing or damaged stones. This work was performed under traffic except when the shoes were jacked up to permit work underneath.

Polymer Concrete

Polymer concrete consists of aggregate combined with a monomer which is polymerized in place. The material usually develops compressive strengths in excess of 5000 psi within 2 hours of placement, and bonds well to concrete. The chemicals used are volatile and may be toxic. Any of the chemical substitutes for Portland cement concrete are relatively expensive. They should be used only where volumes are very small or where their rapid curing is desired.

To illustrate, a bridge had unreinforced concrete piers which had been banded to provide some "external reinforcement". When the top band broke at one of the piers, a portion of the cap fell out from under the shoes. Falsework was installed to restore traffic and repairs were made. All piers were injected and the damaged pier cap was replaced with conventional concrete, instead of a polymer, since the spans were on falsework, and cure time was not a problem.

A bridge over a highway had rubble filled concrete shell piers. The shells had deteriorated badly, so the interior was filled with cement grout to consolidate the rubble, and the shells were epoxy injected.

A concrete railroad structure located beneath a combination railroad/highway bridge had experienced severe localized salt damage due to location of an expansion joint above. Deterioration of the concrete slabs had progressed to the stage that complete replacement was considered the only practical alternative. New slabs were cast on the site and installed during an interruption in traffic.

Deteriorated concrete in the piles was removed and the remaining sound concrete was jacketed. The roadway above has since been closed and no further salt damage is expected.

Another railroad's subway bridge had been exposed to salt spray and had been struck by a number of vehicles, so that many of the areas had exposed reinforcing steel. A shotcrete-type application and hand patching were sufficient to put this structure back in good condition.

That same railroad experienced a derailment which destroyed a portion of a cantilever concrete walkway on the deck plate grinder bridge. A new walkway was formed, doweled into what was left of the existing slab and cast in place. The finished product looked as good as new.

An arch structure over a waterway developed a severe crack through the arch very near the center. Concurrently, a power plant was being constructed nearby. Their plans were to dam the waterway to increase the amount of cooling water available. The larger volume of water would result in a higher water level and difficulties in inspecting and maintaining the arch.

Therefore, a permanent repair to this damaged arch was required. After considering several alternatives, a new center pier was constructed during low water to support the crown. The water is much higher today.

The main pier on a bascule span bridge did not always clear tows. One such shipment chamfered the pier top, jeopardizing the span bearing. Anchored reinforcement was placed and the corner rebuilt to once again secure the span.

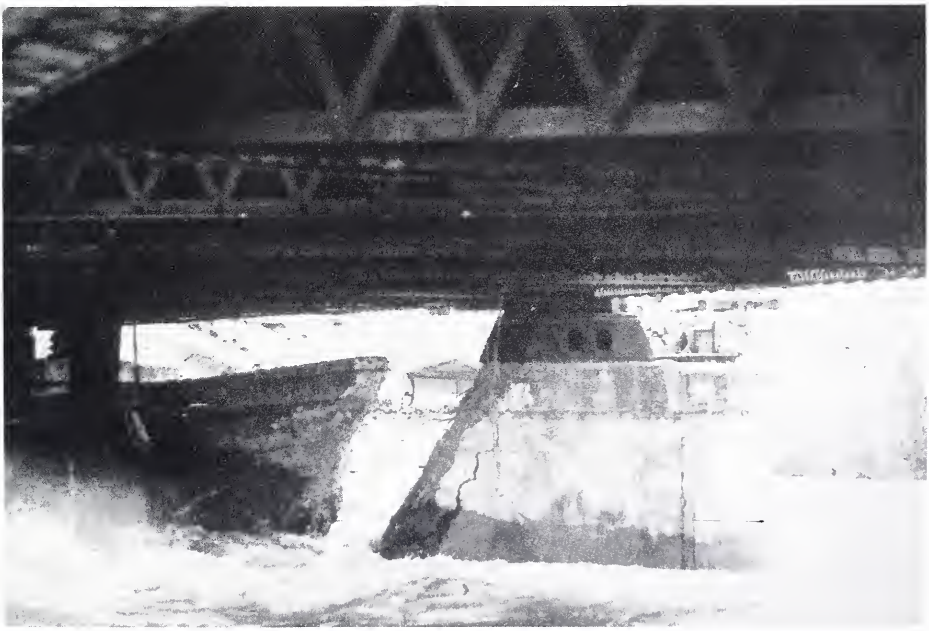
Damage from Scour

High water causing scour can be a problem, as at a double track truss structure where the upstream end of the pier was undermined. The unreinforced concrete pier cracked off completely on the upstream side leaving only that part of the pier that supported the north truss bearings and a passenger train ran over the bridge in this condition. Of course, it was on the track nearer the supported bearing.

The decision was made to place falsework under the truss at the L1 and L2 panel points and as near to the damaged pier as possible to get the bridge back in service until the undermined portion of the pier could be removed from the river and repairs could be made.

Repairs consisted of a grouted curtain wall to bedrock around the entire pier and replacement of the missing portion of the pier with reinforced concrete. The interface between the new and old was doweled, then thoroughly cleaned and wetted immediately before placing the new concrete. This work was done within a timber sheeting cofferdam. The repaired pier is performing well.

Spring flooding scoured out the west abutment on a one-span double track through girder



River pier split by high water

Prestressed span damaged by derailment

bridge. A single track timber shoofly structure was driven to put the line back in service.

The 8-foot long timber piles in the original abutment apparently were not long enough to avert the scouring and the entire unit had to be removed. The 85-foot span was blocked up on falsework while steel piling were driven for a new concrete pier. This bridge was extended one span to the west and the east bank was heavily rip rapped.

Derailment Damage

A three span prestressed concrete overhead highway bridge sustained considerable damage when a derailment destroyed the pier adjacent to the track on the north side, bringing down the two spans the pier supported, and blocking the main line. Incredibly, the pier columns had sheared off at the footing.

An empty bulkhead flat car lead a procession of 25 derailed cars from the middle of the westbound freight train. The derailment apparently occurred at a switch about 1000 feet east of the bridge. The two spans that went down with the pier were damage beyond repair, but otherwise the structure appeared to have received only minor damage. Tire marks on the deck of one of the inclined spans are the only remaining evidence that somebody tried to jump the gap in spite of barricades placed by the State.

The damaged girders and bridge deck were removed by controlled blasting to clear the railroad right of way for reopening of the track. With the clutter removed, the damage to the rest of the structure could be assessed more readily. The south end of the bridge was salvaged, with only minor repairs required to the foundation and deck. Cracks in the columns were epoxy injected. The remainder of the structure was rebuilt in kind, with the exception of the pier, where the design was modified. In the new pier, the collision strut was taken all the way down to the footing, not stopped at the ground line as was done originally.

On Sunday, March 31st of this year a westbound Burlington Northern freight train derailed at about 7:00 a.m. near Glendive, Montana. The derailment occurred just east of Bridge 10, a three span open deck girder structure. The inner guard rail kept the two locomotives upright and they got safely across the span. But nothing else did.

The derailed cars tore through the deck of the first span and into the bracing system. The impact from the cars pushed the span west and dragged it off the east abutment, doing considerable damage to the abutment. The west abutment was heavily damaged also.

A decision had to be made immediately as to whether any of the old structure could be salvaged. Otherwise, the remaining two girder spans would have to be removed and a temporary trestle driven to put the line back in service. Construction of such a temporary bridge would have taken a week.

The regional chief engineer determined that the center girder span and the entire foundation could be resued. A shoofly embankment was placed on an 84-inch culvert, and traffic was reinstated within 48 hours.

Repairs were made to the foundation, and intermediate bents were driven and topped with precast caps. Prestressed tee girders, similar to those used by the MoPac were placed where the end steel spans had been, and the remodeled bridge was put back in service on June 18.

The fact that the concrete foundation on this structure could be repaired probably saved the railroad $500,000. This incident points out the importance of concrete in our bridges and the importance of our being able to repair this marvelous material.

Concrete, as a building material, is relatively new. Stone masonry was in common usage into the early part of this century. Reinforced concrete has been used, as the only foundation material in this country, for about 50 years.

If you are involved in railroad bridge maintenance, there is a challenge out there waiting for you. Our industry owns a lot of bad concrete. The poor concrete is not necessarily the fault of the craftsmen who place it. The work they did then was state of the art. Much of their work has been subjected to salt spray, fires, floods, freeze-thaw, and derailments. For a relatively new material, such as our concrete is, I think it has weathered amazingly well.

But, the damaged concrete does exist and it is our responsibility to maintain it. Any repair work you can perform, which obviates the need for complete replacement, will save your company money. And that is your job. To keep the trains moving safely over your structures at a minimum cost to your company.

President Williams: Thank you, Ken. It was a very interesting presentation. It looks like this whole conference is fixing up catastrophes.

Our second Special Subject will be introduced by the sponsor, Bill Cunningham, from the Missouri Pacific. Bill.

Mr. Cunningham: The next Special Subject this morning is entitled ‘‘Mandated EPA Requirements for Asbestos Removal’’ and will be presented by Bob Fronczak, Director Environmental Control for the Soo/Milwaukee.

Mr. Fronczak received his civil engineering degree from Valparaiso University in 1974. Shortly after graduation, he joined a consulting engineering firm. Mr. Fronczak joined the Milwaukee Road in 1979 as an environmental engineer and was promoted to director of environmental quality in 1981. He recently completed his Master’s Degree in Business Administration at DePaul University. Bob is an active member of the Environmental Committee of AREA, and he is a professional registered engineer in Illinois and Iowa. Bob.

SPECIAL SUBJECT NO. 2

Mandated EPA Requirements for Asbestos Removal

Chairman: R.E. Fronczak, Dir. of Enviro. Control, Milwaukee Road, Chicago, IL

Committee: P.C.L. Conlon, MGr. Envir. Studies Divn., AAR, Washington, DC
C.R. Lund, Engr. Mech., Milwaukee Road, Chicago, IL
C.W. Harmon, Envir. Engr., ICG, Chicago, IL
J.J. Horney, B&B Sys. Supv., UP, Omaha, NE

Introduction

In a paper entitled "Mandated EPA Requirements for Asbestos Removal" the first question that comes to mind is why were EPA requirements mandated in the first place. The use of asbestos dates back some 2,500 years. History suggests that some of the first uses of asbestos were for cremation clothing and wicks for temple lamps. It was not until the invention of the steam engine in the 19th century that the first real commercial applications of asbestos were realized. Because of its fire resistant properties, asbestos was promoted and used in the 20th century for use in textiles, frictional material, structural fireproofing, floor tile, paints, roof coatings, plastics, etc. Asbestos used by industry increased at an average rate of 13 percent per year between 1956 to 1967 and at a growth rate higher than that into the early 1970's. U.S. consumption of asbestos for use in the various applications cited above amounted to 806,000 tons in 1965. Due to health related problems uncovered by medical research, however, the U.S. Environmental Protection Agency decided to prohibit the application of asbestos pipe covering and boiler lagging in 1975. Consequently, demand for asbestos in the U.S. in 1984 was only 30 percent of what it was at its peak in 1973[1].

Asbestos Regulation

Two decades ago, concerns about asbestos hazards centered on workers exposed to large amounts of fibers in their work places. In the 1960's and 1970's, many studies were made concerning the effect of asbestos. In the 1960's epidemiological studies showed that insulation workers who had dealt with asbestos for 20 years or more were dying of cancer and the complications of asbestosis at alarming rates. Later, a few people whose only contact with the material was that they lived in the same house as asbestos workers, were found to be dying of mesothelioma. Because of these studies, asbestos became the first material to be regulated by the newly formed Occupational Safety and Health Administration in 1971.

In 1982, lawsuits filed by workers suffering from asbestos related diseases led the largest U.S. asbestos producer (but since 1983 out of that business) to look for an escape from the rising costs in bankruptcy court. What are these diseases that result from excess exposure to asbestos, i.e., asbestosis, lung cancer, and mesothelioma?

Asbestosis is a type of pulmonary fibrosis or scarring of the lungs. Victims become short of breath, and eventually they may struggle so hard to breathe they die of heart failure. Asbestosis usually develops after years of heavy exposure to asbestos in the workplace.

Epidemilogical studies have also shown that occupation exposure to asbestos can produce lung cancer, frequently developing after a latency period of 10 to 30 years. Studies indicate that the risk of getting lung cancer multiplies if the worker exposed to asbestos also smokes. "Lung cancer death rates (deaths per 100,000 person-years) range from 11.3 for unexposed non-smokers to 58.4 for exposed non-smokers and from 122.6 for unexposed smokers to 601.6 for exposed smokers.[2]"

Mesothelioma is a very rare, always fatal, form of cancer of the lining of the lungs and abdominal cavity. The vast majority of these cancers were in people exposed to crocidolite alone or in combination with other types of asbestos. There is a background of naturally occurring mesotheliomas of about ten for males, and four for females, per million persons ages 45 years or older. The risk of contracting this type of cancer is multiplied if exposed to asbestos at a very young age, however, there is no significant increase in risk associated with smoking.[3] The reason the risk is higher for people exposed at a young age is because of the longer time it takes the cancer to develop, up to 40 years in some cases.

All in all, the EPA has estimated that over the next 30 years, about 1,000 premature deaths (minimal and maximal estimates — 100 and 7,000 respectively) will result from current and future exposures to asbestos released from friable building materials.[4] The reason the EPA feels that this is a significant problem is because EPA feels that these deaths can be prevented.[5]

Information such as the foregoing has led to the following actions:

- — major court actions authorizing product liability lawsuits by workers exposed to asbestos products against manufacturers of those products.
- — large number of personal injury lawsuits filed against employers.
- — asbestos regulation development for workers exposed and for the reduction of child exposure in schools.
- — inability of asbestos contractors to obtain insurance.
- — class action suits against contractors for "improper" removal of asbestos from schools.

A recent court decision in Knoxville, TN, decided that two former asbestos-product producers are not liable for costs of removing asbestos from schools because asbestos was shown to be not harmful when properly maintained. This case will likely be appealed, however.[6]

What is Asbestos?

Asbestos is a general name given to a variety of useful naturally occurring minerals. all of these minerals have one common attribute which is the ability to be separated into soft silky fibers which have high tensile strength and high heat resistance. All commercial varieties of asbestos are silicates, that is, minerals where SiO_4 tetrahedra form the backbone of the crystal lattice. There are two main groups of asbestos, the serpentine group and the amphibole group. These groups are broken down into their mineral name and chemical formula in Table I.[7]

The serpentine group has only one commercial form of asbestos, i.e., Chrysotile. This form of asbestos is also called white asbestos. Most asbestos being produced today is chrysotile, primarily from Canada and the USSR.

The amphibole group contains all other commercial forms of asbestos. Only two amphiboles have been exploited commercially as asbestos to any significant degree. Crocidolite (blue as-

TABLE 1

SOME SILICATES CAN CRYSTALLIZE AS ASBESTOS FIBERS

MINERAL NAME	CHEMICAL FORMULA	ASBESTIFORM VARIETY
SERPENTINE GROUP		
Serpentine	$Mg_6Si_4O_{10}(OH)_8$	Chrysotile (white)
AMPHIBOLE GROUP		
Riebeckite	$Na_2Fe_3{}^{2+}Fe_2{}^{3+}Si_8O_{22}(OH,F)_2$	Crocidolite (blue)
Cummingtonite-grunerite	$(Mg,Fe^{2+})_5Si_8O_{22}(OH)_2$	Cummingtonite-grunerite asbestos
Tremolite-actinolite	$Ca_2(Mg,Fe^{2+})_5Si_8O_{22}(OH)_2$	Tremolite-actinolite asbestos
Anthophyllite	$(Mg,Fe^{2+})_7Si_8O_{22}(OH,F)_2$	Anthophyllite asbestos

bestos) currently is only mined in South Africa. Cummingtonite-grunerite asbestos (brown asbestos) is produced in the Tranvaal Province of South Africa. This type of asbestos is often called amosite.

The importance of the differences between the two types of asbestos materials makes itself apparent in studies performed in different countries. British and Canadian studies indicate that chrysotile asbestos poses a much lesser degree of hazard than does the amphibole asbestos. Although scientists appear to agree that chrysotile asbestos does post a lesser hazard, a hazard still does exist and must be dealt with.

The term friable asbestos referred to above is defined by the USEPA as ''material containing more than one percent asbestos by weight that hand pressure can crumble, pulverize or reduce to powder when dry''. This is important as asbestos is primarily an air pollutant hazard.

One way of reducing the potential toxic affects of asbestos is to remove it from the air. One of the easiest ways of accomplishing this is by simply wetting dry asbestos with water.

Sampling Procedures

The regulations concerning asbestos come from two sources. The regulations governing the removal and disposal of asbestos are promulgated and enforced by the USEPA. These regulations will be covered in detail later. Regulations governing the employee handling and exposure are promulgated and enforced by the Occupation Safety and Health Administration (OSHA). Rules covering asbestos are contained in 29 CFR 1910.1001. Table 2 briefly outlines the requirements of this regulation.[8] The OSHA requirements are outside the scope of this paper, however, since sampling is an issue of controversy, it appeared appropriate to bring this issue up at this time.

The first step in an asbestos abatement program is risk analysis. This risk analysis starts with a survey of facilities, existing drawings, and specifications, to locate materials that are likely to release asbestos fibers. At this time, it may be necessary to take actual samples of materials suspected of containing asbestos. The easiest method of taking a sample is to use a sharp knife to cut off a small piece of the material. The date and location of sample should be noted on a bag to contain the material.

The material should be analyzed for bulk asbestos content. The method most commonly used to determine the percentage of asbestos in the sample is the polarized light microscopy technique. A publication entitled ''Commercial Laboratories with Polarized Microscope Capabilities for Bulk Asbestos Identification'' lists testing laboratories that participate in the EPA Bulk Sample Quality Assurance Program. It is available from the EPA in Washington, DC. Laboratories participating in the program are periodically mailed a series of samples by

TABLE 2

OUTLINE OF OSHA REQUIREMENTS CONCERNING ASBESTOS[8]

1. Maximum 8 hour time weighted average and ceiling concentrations of 2 fibers longer than 5 micrometers per cubic centimeter of air (2f — 5 um/cc) and 10 f — 5 um/cc respectively.
2. Methods of compliance including engineering controls and work practices.
3. Personal protective clothing to be used.
4. Methods of measurement.
5. Methods of monitoring.
6. Caution signs and tables required.
7. Housekeeping requirements.
8. Medical examinations.

the EPA and evaluated according to their success in identifying those samples containing more than one percent asbestos.

Personnel protection while taking a sample of asbestos is a topic of much debate. At the minimum, a disposable respirator suitable for asbestos should be used. Some people, however, believe full personal protective equipment should be utilized. Your supervisor should be contacted to determine the company policy for sampling.

Asbestos air sampling is required during and after abatement projects. Its use is of questionable value in long term monitoring, however. This is because high concentrations of fiber release can occur sporadically during disturbance by maintenance personnel. Because of time weighted averaging, this short duration, high concentraton may go undetected.

Presently, OSHA specified a permissible exposure to airborne concentrations of asbestos not to exceed 2 f-5um/cc on an 8-hour time weighted average and a ceiling concentration of 10 f-5um/cc. NIOSH recommended that OSHA lower the standard to an 8-hour time weighted average of 0.1 f-5um/cc.[9] Although an emergency temporary standard was issued in 1983 by OSHA, this standard was suspended by judicial order on November 23, 1983, and the limit of 2 f-5um/cc still exists.

It should be noted that OSHA regulates fibers more than 5 um long even though most fibers, perhaps 95 percent, are shorter than 5 um. OSHA reasons that longer fibers are a fair index of the entire amount of asbestos present. This is significant, because fibers of this size are resolvable by a 400-500X magnification phase contrast microscope (PCM). These tests cost $25 to $45 per sample.

Some researchers believe that asbestos fibers less than 5 um long may be carcinogenic and they should be included in the airborne fibers count; however, only supplemental use of more sophisticated analytical electron microscope methods would permit detection of such short fibers. The Transmission Electron Microscope (TEM) test can give crystallographic structure of a fiber to distinguish asbestos from other fibers such as glass, cellulose, and carbon fibers which may be counted as asbestos in the PCM method. Many labs are not set up to do this kind of analysis, however, and analysis can run as much as $300 to $500 per sample. For that reason, Scanning Electron Microscopy (SEM) which is cheaper and more accessible is often suggested as a substitute for TEM. Since both EM techniques use a method that removes organic materials and break clumps of fibers so individual submicron fibers can be seen, the number of fibers does not reflect the number in the original sample. Results, therefore, are expressed as the mass of asbestos per volume of air (i.e. ng/m^3). An approximate conversion factor of 30 f/ng has been determined but considerable uncertainly about this conversion factor exists.[10]

Regardless of the method of analysis, some companies take the stand that the new proposed 0.1 5-5um/cc standard ought to be the standard used for measuring airborne asbestos concentrations prior to and after asbestos removal work. These people limit asbestos levels after completion of the work to levels below the 0.1 standard.

Where to Find Asbestos

Table 3 lists the typical percentages by weight of asbestos in various products. The largest category of products are asbestos cement products that comprise more than 60 percent of the total U.S. consumption of asbestos. Included in this category are the manufacture of groutings, wallboard finishing compounds, asbestos building boards, and asbestos cement pipe. Table 4 has been prepared to show some of the numerous locations where asbestos can be expected on the railroad. This list is intended to be representative of the places asbestos might be found and is not all inclusive.

EPA Requirements for Asbestos Removal and/or Encapsulation

The U.S. Environmental Protection Agency (EPA) regulates the removal and disposal of asbestos under authority of the Clean Air Act. Regulations concerning asbestos are published in Title 40 of the Code of Federal Regulations, Part 61.

In some instances states have been delegated the responsibility of regulating the removal and disposal of asbestos. To ensure compliance with all applicable regulations, contact should be made with the EPA regional Asbestos Coordinator to determine whether the state where the work is to be done has been delegated asbestos regulatory responsibility.

TABLE 3

PROPORTION OF ASBESTOS IN VARIOUS PRODUCTS

PRODUCT	PERCENT ASBESTOS BY WEIGHT
Asbestos textiles	80-100
Asbestos cement	15-90
Friction materials & gaskets	30-80
Asbestos paper products	80-90
Floor tile	10-30
Paints, roof coating, caulks	5-25

TABLE 4

TYPICAL SOURCES OF ASBESTOS ON RAILROADS

1. Asbestos cement pipe
2. Boiler insulation (heating plants)
3. Brake shoes
4. Building insulation
5. Ceiling tile
6. Exterior pipe lagging (steam pipes — bridges)
7. Floor tile
8. Gaskets (boiler doors)
9. Lightweight concrete
10. Mounting board in signal relay houses
11. Pipe lagging in buildings
12. Roof insulation
13. Siding
14. Steam engine insulation
15. Structural fire proofing
16. Tank insulation

Asbestos Removal

There are basic standards in effect that must be used when evaluating the proposed renovation or demolition activity. Renovation is defined as altering in any way one or more facility components. Demolition means the wrecking or taking out any load-supporting structural member of a facility together with any related handling operations. If the amount of friable asbestos materials (containing more than one percent asbestos by weight that can crumble, pulverize, or reduce to powder when dry) in a facility being demolished or renovated is at least 260 linear feet on pipes or at least 160 square feet on other facility components such as walls or ceilings, then all of the notification and emission control standards listed in Table 5 apply. If the amount of friable asbestos materials involved is less than 260 linear feet on pipes or 160 square feet on other components, the notification requirements do not need to include items f, g, and h of Table 5.

If the facility is being demolished under an order of a State or local governmental agency, issued because the facility is structurally unsound and in imminent danger of collapse, the notification described above must also include the name, title, and authority of the governmental representative who ordered the demolition.

If the structure or facility is expected to be renovated over a long period of time and asbestos removal will occur on an unscheduled basis, the amount of asbestos that would be removed within one year should be used to determine whether total quantities involved exceed 260 linear feet on pipes or 160 square feet on other surfaces.

If EPA has delegated this responsibility to the particular state involved, the appropriate state agency should be contacted. Several states require not only the information described in items f, g and h in Table 5, but place other requirements on the owner of the facility being renovated or demolished.

It is the intent of the EPA rules to prevent emissions of particulate asbestos materials to the outside air. Particulate asbestos particles are defined as finely divided particles of asbestos materials. Friable asbestos materials must be removed from a facility being demolished or renovated before any wrecking or dismantling

TABLE 5

ASBESTOS NOTIFICATION REQUIREMENTS FOR DEMOLITION AND RENOVATION

1. Write to EPA Administrator, 401 M Street S.W., Washington, D.C. 20460, or the appropriate state agency (if EPA has delegated its authority), providing notice of intent to demolish or renovate structure.

2. Notice of intent must be postmarked or delivered to EPA at least 10 days before demolition begins, or as early as possible before renovations begins.*

   (In the event that the state has been delegated responsibility for asbestos removal and disposal regulation, the notice of intent requirements may vary.)

3. The notice must include the following information.
   a. Name and address of owner or operator of facility.
   b. Description of facility being renovated or demolished, including size, age, and prior use of the facility.
   c. Estimate of amount of friable asbestos material in facility.
   d. Location of facility.
   e. Scheduled start and completion dates of demolition or renovation.
   f. Nature of demolition or renovation methods to be used.
   g. Procedures to be used to comply with EPA removal and disposal regulations.
   h. Name and location of the waste disposal site where the friable asbestos waste material will be deposited.

*NOTE: Notice must be given 20 days before demolition begins if the operation has less than 260 linear feet of pipe or 160 square feet on other facility components.

takes place that would break up the materials or prevent access to the materials for subsequent removal. Under certain conditions, friable asbestos materials do not need to be removed before demolition begins. These are if the asbestos is on a facility component that is encased in concrete or other similar material, and these materials are adequately wetted whenever exposed during demolition.

Friable asbestos materials must be adequately wetted when they are being stripped from facility components before the components are removed from the facility. When a facility component covered or coated with friable asbestos materials is being taken out of the facility in units or sections, any friable asbestos materials must be adequately wetted when exposed during cutting or disjointing operations. These units or sections should be carefully lowered to ground level, not dropped or thrown.

One unique removal method utilizes a bag that can be placed around piping where all removal can take place within the bag. The bag has built in gloves in which to insert a person's hands to do the removal work. Once the tools necessary to remove the asbestos are placed inside the bag, the bag is zippered around the pipe. Straps are placed around the pipe at the ends of the bag to form a tight seal. Once the bag is secured, the tools can be maneuvered to cut the asbestos from the pipe into the lower portion of the bag. A valve is provided to spray water on the exposed insulation and pipe after asbestos removal inside the bag. The shoulder straps can then be loosened and moved down the pipe for additional removal until the bag is full. When the bag is full, another plastic bag can be pulled over the full bag and sealed making it ready for disposal. When using this technique, caution should be used to adequately wet removed asbestos and clean pipe. As the bag is moved along the pipe, airborne asbestos inside the bag could enter the room. Also, as the pipe dries, any asbestos remaining on the pipe could become airborne. Tools should be wet down after finishing with each bag. The bags should then be placed in a container for transport to the disposal facility to avoid tearing the bags enroute.

In renovation operations, if wetting the asbestos would unavoidably damage equipment, the owner or operator should write to the EPA Administrator, asking for an official determination of this fact. Once the Administrator confirms this, a local exhaust ventilation and collection system must be designed and operated to capture the particulate asbestos material produced by the stripping and removal of the friable asbestos materials. This system must follow the guidelines in Table 6.

After a facility component has been taken out of the facility as units or in sections, the friable asbestos materials must be adequately wetted during stripping operations or a local exhaust ventilation and collection system, as outlined in Table 6, must be used to capture the particulate asbestos materials produced by the stripping.

Friable asbestos materials that have been removed or stripped must remain adequately wetted until collected for disposal. They must not be thrown or dropped to ground level, but carefully lowered to prevent dispersal of asbestos particulate into the outside air. Dust tight chutes or containers may be used if the materials were removed or stripped more than 50 feet above the ground and were not removed as units or in sections.

When the temperature at the point of wetting is less than 32°F, the materials need only be wetted after removal. A local exhaust ventilation system will also control emissions. Friable asbestos covered materials should be removed in sections or as units to the extent possible under freezing conditions.

When a building is being demolished, the portion containing friable asbestos materials must be adequately wetted during the wrecking operation.

Asbestos Waste Disposal

All asbestos containing waste material must be disposed of at waste disposal sites operated in accordance with EPA rules. No visible emissions to outside air must occur during the collection, processing (including incineration), packaging, transporting, or deposition of any asbestos containing waste material. This may be accomplished by any of the following methods.

Asbestos-containing waste material may be treated with water to form a slurry. The waste must be adequately wetted, and no visible emissions to the outside air may occur during the process. After wetting, all asbestos containing waste material must be sealed in leak-tight con-

TABLE 6

GUIDELINES FOR ASBESTOS AIR CLEANING SYSTEMS

1. Use fabric filter collection devices.
2. Operate the fabric filter collection devices at a pressure drop of no more than four inches water gauge, as measured across the filter fabric.
3. Ensure the air flow permeability, as determined by ASTM Method D737-75, does not exceed 30 $ft^3/min/ft^2$ for woven fabrics or 35 $ft^3/min/ft^2$ for felted fabrics.
4. Ensure that felted fabric weighs at least 14 ounces per square yard and is at least one-sixteenth inch thick throughout, avoiding the use of synthetic fabrics that contain fill yarn other than that which is spun.
5. The air cleaning equipment must be properly installed, operated, and maintained. Bypass devices may only be used during emergency conditions, and then only for so long as it takes to shut down the operation generating the particulate asbestos materials.
6. If the use of fabric creates a fire or explosion hazard, the EPA Administrator may authorize the use of substitute wet filters.
7. The EPA Administrator may authorize the use of other filtering equipment if it can be demonstrated that it will perform in a manner similar to that described above. An alternative system is described in EPA report 560/5-83-002 "Recommended Specifications and Operating Procedures for the Use of Negative Pressure Systems for Asbestos Abatement."

tainers while wet. The labels must have the following wording:

CAUTION

CONTAINS ASBESTOS
AVOID OPENING OR BREAKING
CONTAINER. BREATHING ASBESTOS
IS HAZARDOUS TO YOUR HEALTH

As an alternative, warning labels specified by the Occupational Safety and Health Administration may be used. These labels state:

CAUTION

CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
BREATHING ASBESTOS DUST MAY
CAUSE SERIOUS BODILY HARM

Asbestos-containing waste may be formed into non-friable pellets or other shapes. No visible emissions to the outside air emanating from the collection or processing system are allowed. Any other disposal method must be approved by the EPA Administrator prior to its use.

Asbestos Waste Disposal Sites

To be an acceptable site for disposal of asbestos-containing waste material, a waste disposal site must meet certain requirements for emission control and deterring public access. No visible emissions to the outside air from the site are allowed. If this is not possible, the disposal site, while in continuous operation, should be covered over daily with at least six inches of compacted non-asbestos containing earth, or a dust supression agent approved by the EPA Administrator.

Unless there is a natural barrier that adequately deters access to the disposal site by the general public, as determined by the EPA Administrator, warning signs and fencing must be installed and maintained. Warning signs must be located at all entrances and at intervals of 300 feet or less along the property line or perimeter of the site. The signs must conform to EPA specifications as follows: The sign must be 14x20 inches, in a vertical format and display the following legend in the corresponding letter sizes.

Legend

ASBESTOS WASTE DISPOSAL SITE

Notation

1-inch Sans Serif, Gothic, or Block lettering

Legend

DO NOT CREATE DUST

Notation

¾-inch Sans Serif, Gothic or Block lettering

Legend

BREATHING ASBESTOS IS
HAZARDOUS TO YOUR HEALTH

Notation

14-Point Gothic Lettering

Spacing between any two lines must be at least equal to the height of the upper of the two lines. Alternative emission control methods must be approved by the EPA Administrator.[11] [12]

It should be pointed out that while almost all states control the programs for asbestos removal within the state, some states delegate enforcement to lower levels of government such as county and even city levels. This information can be obtained through the state agency handling the asbestos program.

Contractors

With the advent of regulations regarding asbestos, a new industry has been born, i.e., the asbestos removal industry. Many companies are reputable; however, some companies have formed with little experience in a highly technical and sensitive field. This is exemplified by a lawsuit filed by the tenants of a 17th floor medical towers building. The plaintiffs charge that they were exposed to asbestos dust and now have increased risk of getting cancer. The suit claims $15 million in damages against the building manager and a contractor who remodeled the 18th floor last summer.[13]

One method some states have of assuring some sort of quality in contractors is to offer training programs and/or certification programs for persons involved in asbestos work. The Asbestos School Hazard Abatement Act of 1985, which gave the states $50 million in fiscal year 1985 to assist local school districts with asbestos control, also requires states to certify contractors. Some states already have certification requirements. Georgia Tech University offers a training program for building owners, architects, contractors, and other people managing asbestos. This program has been offered 15 times since its inception in 1982. Presently, Georgia Tech is developing a model one-week training program for asbestos abatement supervision under EPA contract.

Another organization which has formed as a result of the asbestos regulations is the National Asbestos Council (NAC). This organization, which is comprised of contractors, building owners, architects, analysts and other professionals concerned about proper asbestos abatement, is developing training materials for small contractors and maintenance personnel. The National Association of Asbestos Abatement Contractors was formed to pool knowledge and experience in asbestos contractors across the country.

One way to insure that asbestos contractors are bidding on work in a comparable method is by writing a tight specification. Many contractors have their own specification that they will submit to owners removing asbestos. These specifications should be closely scrutinized to determine that all regulatory requirements are met. The Association of the Wall and Ceiling Industries (AWCI) and the Foundation of the Wall and Ceiling Industry (FWCI) have published a document entitled ''Guide Specifications for the Abatement of Asbestos Release from Spray or Trowel-Applied Materials in Buildings and Other Structures''.[14] These specifications have been prepared to assist architects, engineers, and building owners in preparing project specifications and contracts for asbestos work. The specifications are based on the Construction Specification Institute format. Comments are provided to aid the specifier in editing the specifications to fit the conditions of each particular job. The specifications also provide the following forms suggested for use in contracting asbestos work:

1. Air Test Samples Sampling Data Sheet
2. Ten Day Notice Form

3. Asbestos Disposal Form
4. Final Inspection Form
5. Employee Release Form

Copies of these forms are attached as Appendix 1.

One item of particular concern recently concerning contractors is the issue of insurance. Liability insurance is getting harder and harder to obtain. According to William A. Mahoney, J.D., of Marsh and McLennan Inc., many companies are specifically excluding coverage to firms that deal with asbestos.

He stated that "before the end of the year, only one firm will be insuring companies dealing in asbestos removal work." If something isn't done to correct this problem, asbestos work will soon grind to a halt. One possible solution to this problem would be for state insurance commissioners to create an assigned risk pool as is done for worker's compensation. Another solution would be for the federal government to start a reinsurance program as in the case of the flood and nuclear power plant issues. In any case, it behooves owners of buildings containing asbestos on which demolition or renovation is being done, to make sure contractors have insurance that specifically covers asbestos removal work.

What Do Railroads Do?

Should all asbestos be removed from all buildings? This question is impossible to answer. Basically, it is the opinion of most people that asbestos problems be handled on a case by case basis. In some instances, the risk associated with removing the asbestos may be greater than leaving the asbestos in place and maintaining it properly. The EPA has published a booklet called "Guidance for Controlling Friable Asbestos-Containing Materials in Buildings". This document was prepared primarily to help school authorities to decide what to do when they find asbestos. The principles used in this document could also be applied to any building project involving asbestos.

Some railroads feel that the liability posed by asbestos is too great to take chances. These railroads are taking a systematic inventory of all asbestos in buildings and are planning removal of all asbestos. Other railroads are looking at asbestos on a case by case basis as problems arise. Still other railroads have specific policy guidelines involving the handling of asbestos related problems including respirator programs and guidelines for purchasing materials. Purchasing guidelines may state that no material or supplies containing asbestos may be purchased unless the item is essential to operations and no satisfactory non-asbestos substitutes exist.

The EPA recommends the following procedures for different types of asbestos control options[15]

1. Encapsulation (with an effective sealant) reduces the likelihood that fibers will be released into the building environment as long as the sealant remains intact. If this method is used, a comprehensive asbestos hazard program should be instituted on the basis of current OSHA regulations and NIOSH recommendations. Such a program should include the designation of one competent administrator who would be responsible for organizing and conducting routine periodic inspections and environmental monitoring (using the lowest feasible action level, e.g., 0.01 f/cc^3); education and training of potentially exposed individuals; respirator selection, maintenance, and use; and recordkeeping.

2. Enclosure (with a barrier such as a suspended or false ceiling) reduces the likelihood that incidental contact with the asbestos-containing material will occur as long as the barrier remains intact and entry into the enclosed space is not required. If this method is used, a comprehensive asbestos hazard program, as described above, would be advisable.

3. Administrative management may effectively minimize the problem if no action is required immediately and if potential sources are inspected periodically. If this method is used, a comprehensive asbestos hazard program, as described above, would be advisable.

4. Removal eliminates the source of the contamination. However, control by removal may cause considerable exposure risk for workers and for future occupants unless disrupted material is removed properly and completely, appropriate work practices are used, and respiratory protection is provided.

Conclusion

There is a myriad of information available on asbestos from medical studies to engineering controls to regulations. This is not a topic to be taken lightly. There is a significant liability from personal injury lawsuits, and the risks are to a large extent uncertain. It is an issue that should be considered carefully by legal, medical, insurance, and engineering departments so solutions can be developed that are satisfactory to all involved.

[1] Zurer, Pamela S., ''Asbestos — The Fiber That's Panicking America'', Chemical & Engineering News, March 4, 1985.

[2] Nicholson, W.J., Rohl, A.M., Weisman, I., ''Asbestos Contamination of the Air in Public Buildings'', NTIS #PB-258-930, Springfield, VA. USEPA, October 1975.

[3] Mason, J.O., ''A Review of the Scientific Basis for EPA's School Asbestos Hazard Program with Recommendations to State Health Officials Centers for Disease Control'', Georgia Center for Environmental Health, Atlants, GA, October 1084.

[4] Ibid.

[5] Nicholson, W.J., ''EPA Update on Asbestos Health Effects'', New York, N.Y., Environmental Sciences Laboratory, Mt. Sinai School of Medicine, 1983.

[6] ''Asbestos Firms Win Case'', Wall Street Journal, March 15, 1985, Pg. 6.

[7] Zurer, Pamela S., ''Asbestos — The Fiber That's Panicking America'', Chemical & Engineering News, March 4, 1985.

[8] Asbestos Regulations, 29 CFR Section 191.1001, OSHA, Office of Federal Register, 1984.

[9] Finklea, J.F., ''Revised Recommended Asbestos Standard'', NIOSH Publication 77-169, Cincinnati, OH, 1976.

[10] Nelson, J., Nicholson, W.J., Hughes, J.M., et al. ''Final Report of Chronic Hazard Advisory Panel (CHAP) on Asbestos'', Washington, D.C., Consumer Product Safety Commission July 1983.

[11] Conlon, P.R. et al, ''Review of EPA Regulations on the Removal and Disposal of Asbvestos from Buildings'', American Railway Engineering Association, Committee 13, Environmental Engineering, Subcommittee 2 — Air Pollution Control, 1985.

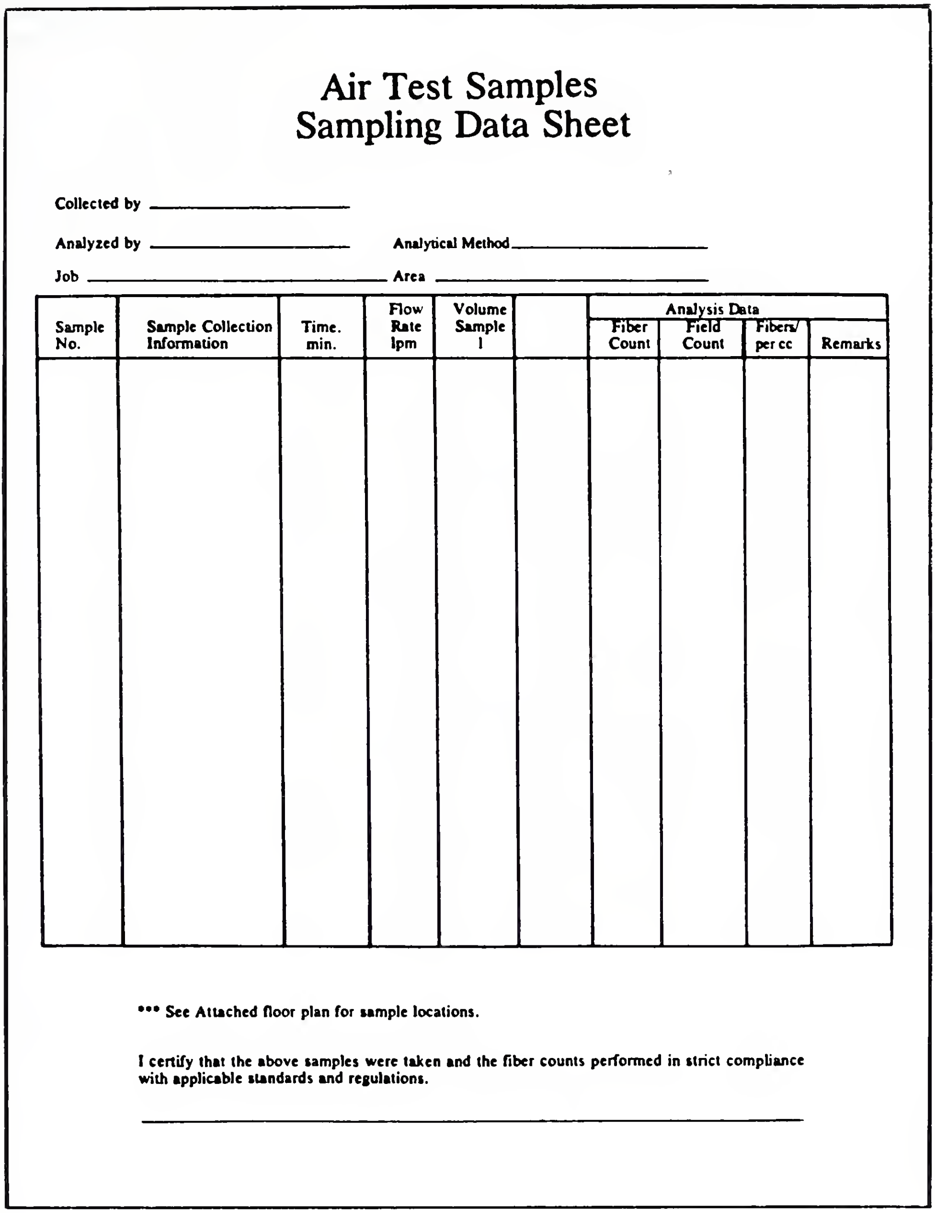
[12] ''National Emission Standard for Asbestos'', 40 CFR 61.140 USEPA, Office of Federal Register 1984.

[13] Zurer, Pamela S., ''Asbestos — The Fiber That's Panicking America'', Chemical & Engineering News, March 4, 1985.

[14] Guide Specifications for The Abatement of Asbestos Release from Spray or Trowel-Applied Materials in Buildings and Other Structures'', Foundation of the Wall & Ceiling Industry, Washington, D.C., 1982.

[15] ''Guidance for Controlling Friable Asbestos-Containing Materials in Buildings'', EPA/OPTS 560/5-83-002, USEPA, Washington, D.C., 1983.

APPENDIX I



Air Test Samples
Sampling Data Sheet

Collected by ____________________

Analyzed by ____________________ Analytical Method ____________________

Job ______________________________ Area ____________________

						Analysis Data			
Sample No.	Sample Collection Information	Time. min.	Flow Rate lpm	Volume Sample l		Fiber Count	Field Count	Fibers/ per cc	Remarks

*** See Attached floor plan for sample locations.

I certify that the above samples were taken and the fiber counts performed in strict compliance with applicable standards and regulations.

____

Ten Day Notice Form

This form is to be filled in and filed with both state and regional EPA officials a minimum of twenty (20) days before start of the asbestos abatement contract.

Contractor ____________________

Name ____________________

Address ____________________

City ____________ **State** ____________ **Zip** ________

Phone (______) ____________________

Building Owner or Operator ____________________

Name ____________________

Address ____________________

City ____________ **State** ____________ **Zip** ________

Phone (______) ____________________

Building Information ____________________

Age of Building ____________________

Use of Building ____________________

Address ____________________

City ____________ **State** ____________ **Zip** ________

Amount of Asbestos (Ft) ____________ **Abatement Technique** ____________

Amount of Asbestos (Ft) ____________ **Abatement Technique** ____________

Contract Dates **Start** ____________ **Finish** ____________

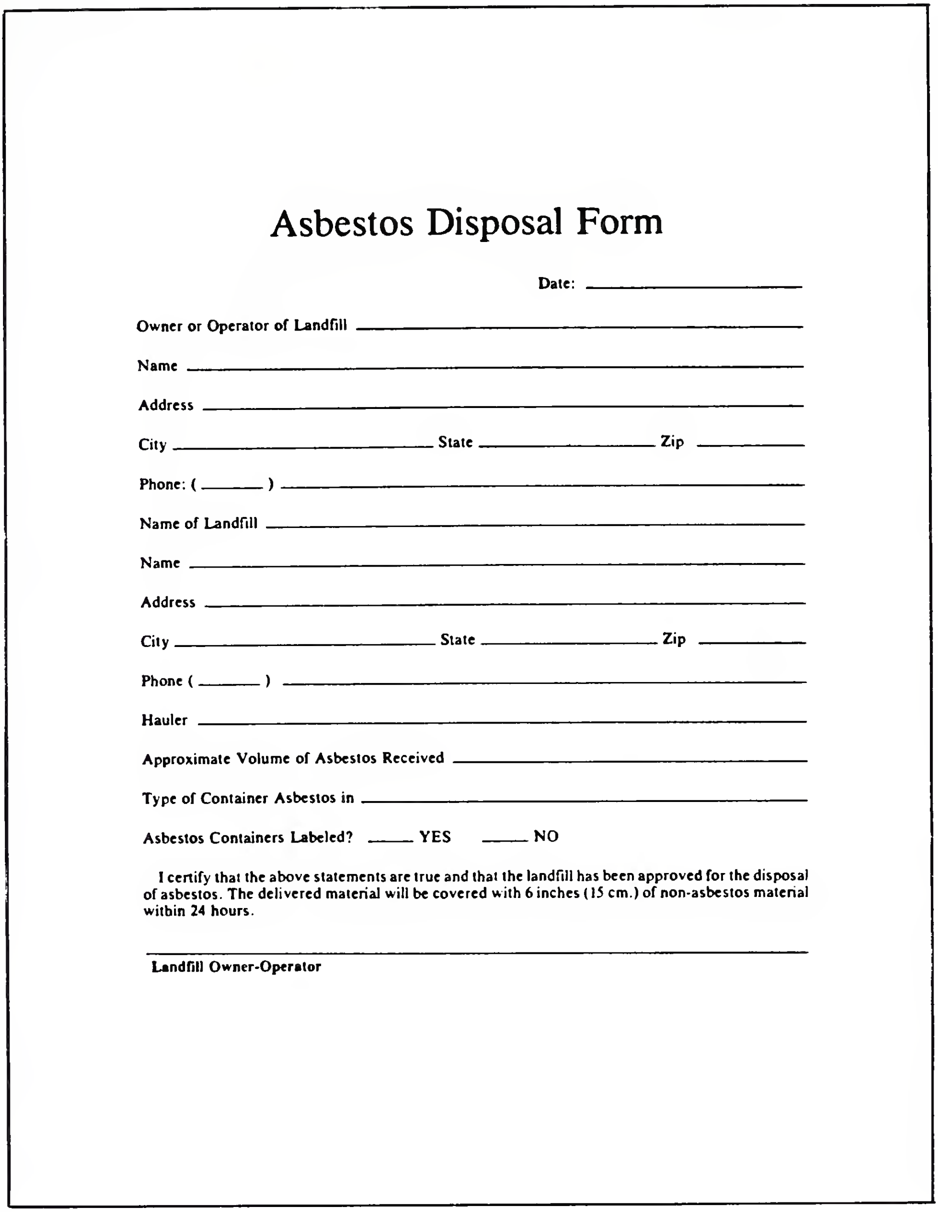
Disposal Site ____________________

Site Name ____________ **Operator-Owner Name** ____________

Address ____________ **Address** ____________

City, State ____________ **City, State** ____________

Phone (______) ____________ **Phone** (______) ____________



Asbestos Disposal Form

Date: ______________

Owner or Operator of Landfill ______________

Name ______________

Address ______________

City ______________ State ______________ Zip ______________

Phone: (______) ______________

Name of Landfill ______________

Name ______________

Address ______________

City ______________ State ______________ Zip ______________

Phone (______) ______________

Hauler ______________

Approximate Volume of Asbestos Received ______________

Type of Container Asbestos in ______________

Asbestos Containers Labeled? ____ YES ____ NO

I certify that the above statements are true and that the landfill has been approved for the disposal of asbestos. The delivered material will be covered with 6 inches (15 cm.) of non-asbestos material within 24 hours.

____

Landfill Owner-Operator

Final Inspection

Form Time: ______________________

Date: ______________________

Name of Job ____

Name of Contractor ____

Location of Job ____

Address ____

City ______________________ **State** ______________ **Zip** __________

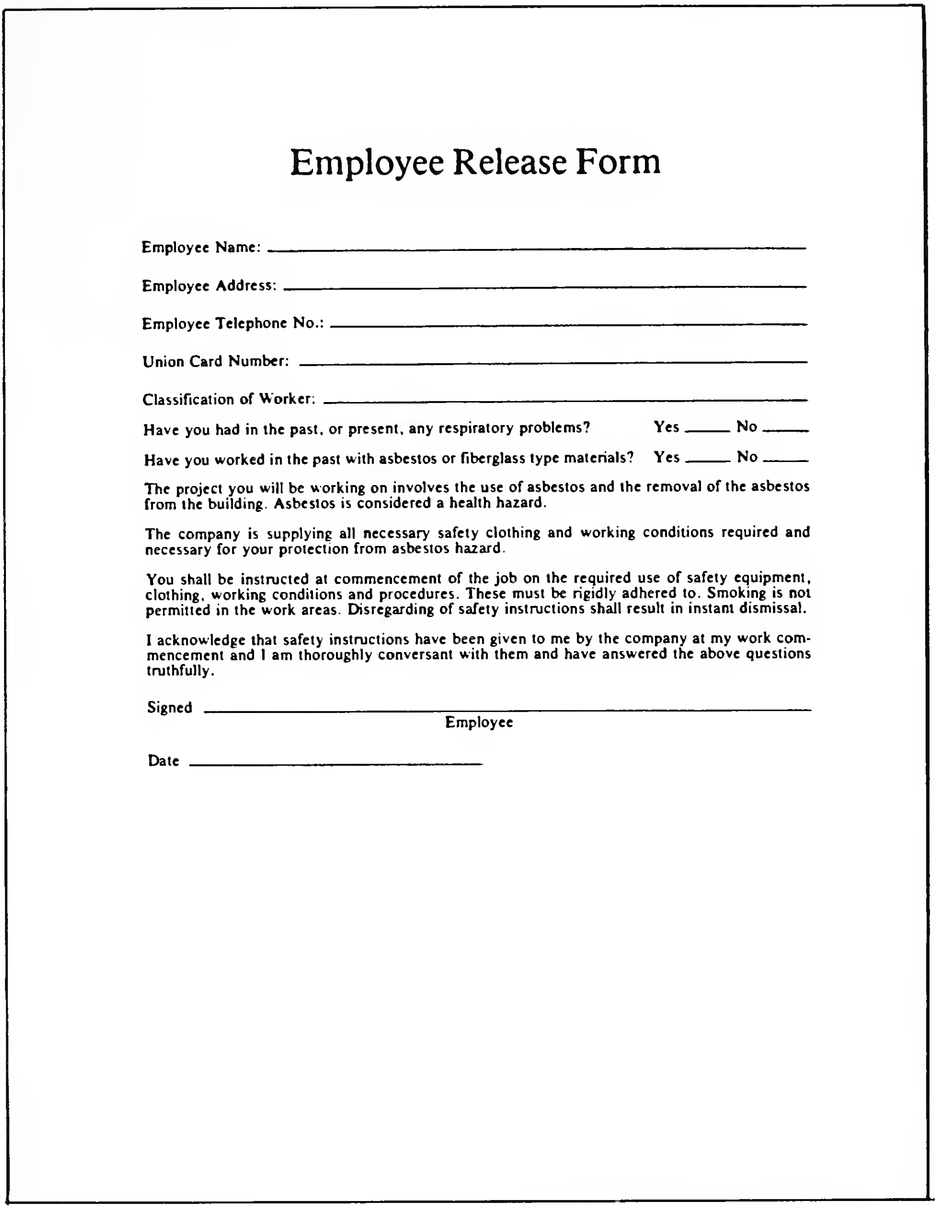
I have inspected the job-site and found it to be clean, orderly and dust-free. All work contracted for has apparently been performed in an acceptable manner in complete accordance with the specifications. There is no obvious damage to the structure.

Comments:

____

Contracting Agent

SEAL (If applicable)



Employee Release Form

Employee Name: ______________________________

Employee Address: ______________________________

Employee Telephone No.: ______________________________

Union Card Number: ______________________________

Classification of Worker: ______________________________

Have you had in the past, or present, any respiratory problems? Yes ____ No ____

Have you worked in the past with asbestos or fiberglass type materials? Yes ____ No ____

The project you will be working on involves the use of asbestos and the removal of the asbestos from the building. Asbestos is considered a health hazard.

The company is supplying all necessary safety clothing and working conditions required and necessary for your protection from asbestos hazard.

You shall be instructed at commencement of the job on the required use of safety equipment, clothing, working conditions and procedures. These must be rigidly adhered to. Smoking is not permitted in the work areas. Disregarding of safety instructions shall result in instant dismissal.

I acknowledge that safety instructions have been given to me by the company at my work commencement and I am thoroughly conversant with them and have answered the above questions truthfully.

Signed ______________________________
Employee

Date ____________________

President Williams: Thank you, Bob, for your interesting report. I know many of us may not be fully up to date on all the government requirements in this area. Please note that there are copies of these special subject reports available at the rear of the room.

The next item on the agenda will be introduced by our Special Feature Chairman, John Kapp. John.

Mr. Kapp: Our next special feature speaker is Mr. Lynn Osborn of Instituform of North America. Mr. Osborn is a graduate of the University of Kansas, where he received his Bachelor's Degree in Civil Engineering. He is a registered professional engineer, and worked for nine years as a consultant in the field of pollution control before joining Instituform of North America two years ago. Right now he is associate technical director. Mr. Osborn.

Reconstruction of Pipelines by the Instituform Inversion Process A State of the Art Technique

by **Lynn E. Osborn**

Associate Technical Director
Instituform of North America, Inc.

Introduction to the Instituform Inversion Process

The inversion process is a new but proven approach to pipeline reconstruction. The process utilizes a polyurethane coated polyester felt tube which is tailored to the diameter and length of the pipe to be repaired. The tube, impregnated with a liquid thermosetting resin is installed by the use of an inversion tube and water pressure, which turns the tube inside out and forces it into the pipe, snugly against the damaged pipeline's interior surfaces. When the tube is fully extended the water is heated and recirculated to harden the resin, thus forming an impermeable corrosion-resistant new pipe within the old.

Upon insertion, the tube is pliable and the resin is in a viscous liquid state, allowing it to bridge gaps, fill cracks, push groundwater aside, and even turn wide angles. And because the tube itself is relatively thin (⅛″to ¾″, depending upon application) it molds itself tightly against the inner walls of the pipe to form a smooth surface that often improves the overall flow capacity. The inversion process can be used in almost any shape pipe — circular, oval, square, egg-shaped — from 4″ to several feet in diameter.

Any connections covered over during the lining process are easily restored using a remote controlled cutter which works from within the pipeline without external excavations. The inversion process is a state-of-the-art technique now gaining wide acceptance across the country.

The cured-in-place pipe within a pipe successfully halts infiltration/exfiltration of groundwater in deteriorated pipe systems. It stops infiltration of fine sand which undermines pipes and causes surface collapse. It prevents root penetration and debris formation by eliminating places for debris to accumulate, thus affording considerable savings in sewer/pipeline rehabilitation, operation and maintenance costs.

Because in the inversion process the tube enters the pipeline through manholes or existing accesses, no or minimal excavation is required. This eliminates much inconvenience normally associated with pipeline repair. Most work is performed in a fraction of the time of other methods, normally 24 hours or less per inversion. By varying the specific resins used (poly-esters, epoxies, vinyl esters, biphenols, etc.) the linings can be installed in nearly all industrial and municipal pipelines — resisting corrosive effluents and atmospheres with great effectiveness.

A Typical Sewer Relining Project

First, the section of pipe to be lined by the process is isolated from the balance of the system by plugging the section of pipe and pumping away upstream flow through a temporary line. The pipe to be repaired is thoroughly cleaned to remove all roots and other debris. A closed-circuit television camera is then used to inspect the pipe for cleanliness, deviations in the existing pipe or other obstructions, and to locate all connections. Water services to users discharging into the affected section of pipe are located and temporarily cut off or the users discharge lines are rerouted as no flow can enter while the liner is being installed. As with the cleaning and inspection, access through existing manholes is again used to insert the liner. Thus, there is virtually no excavation, and therefore little interruption of traffic.

Each Instituform tube is individually tailored to the proper size, wall thickness and length required by the particular installation. At this stage the liner is impregnated with a thermosetting resin, the choice of which is based upon the chemical resistance required by the nature of the effluent or piped product.

The next procedure in the inversion rehabilitation process is the actual insertion of the lining into the damaged pipeline. The installation crew erects temporary scaffolding over the manhole where the lining is to start. An inversion tube is assembled within this scaffolding. The lining, which is in a refrigerated state when it arrives on-site, is installed by inversion. The inversion process is unique within the rehabilitation industry. Once the inversion process is completed, water used to insert the tube is gradually heated to a prescribed temperature and recirculated over a specified time to cure the resin impregnated tube against the inside existing pipe walls. When the curing is completed, an impregnable pipe within a pipe has been formed, thus restoring the line to new pipe or better condition.

BIBLIOGRAPHIC MATERIAL

Table 1

**Physical Properties —
Typical Cured Polyester Linings**

Typical Values

Physical Property	Value	Unit	ASTM Reference
Tensile Properties		psi	D-638
Tensile Strength	3,000	psi	
Modulus of Elasticity	300,000	psi	
Ultimate Elongation at Yield	.8	per cent	
Shear Strength	7,000	psi	D-732
Flexural Properties			
Flexural Strength	3,000	psi	D-790
Flexural Modulus	300,000	psi	
Deformation Under Load (800 psi, 158°F, 24 hrs.)	0.149	per cent	D-621
Coefficient of Expansion	5.96x10	in/in/°C	D-696
Compressure Properties			
Compressive Strength	9,000	psi	D-695
Barcol Hardness	25		

Table 2

Chemical Resistance
Recommended Temperature Limit — Degrees Fahrenheit °F (°C)

Listed below are a few common compounds including acids, alkaline solutions, bleaches, metal salts and solvents, and the corresponding temperature to which a typical cured polyester or vinyl ester product could be subjected under continuous service.

Chemical	% Concentration	Polyester	Vinyl Ester
Acetic Acid	25	105°(66°)	200°(93°)
Acetone	All	N.R.	N.R.
Ammonium Chloride	All	170°(77°)	200°(93°)
Ammonium Hydroxide (Aqueous Ammonia)	20	S.R.	140°(60°)
Ammonium Phosphate	All	140°(60°)	180°(82°)
Benzene	100	N.R.	N.R.
Calcium Hypochlorite	Sat'd	120°(49°)	125°(52°)
Chromic Acid	10	120°(49°)	110°(43°)
Detergents — Cationic Nonionic & Ionic	All	120°(49°)	150°(66°)
Ethyl Alcohol	50	110°(43°)	110°(43°)
Ferric Chloride	All	170°(77°)	200°(93°)
Ferric Nitrate	All	170°(77°)	200°(93°)
Ferric Sulfate	All	170°(77°)	200°(93°)
Fuel Oil	100	150°(66°)	200°(93°)
Gasoline, high aromatic	—	80°(27°)	110°(43°)
Hexane	100	80°(27°)	110°(43°)
Hydrochloric Acid	10	160°(71°)	200°(93°)
	15	150°(66°)	200°(93°)
	20	140°(60°)	150°(66°)
	37	S.R.	110°(43°)
Lactic Acid	All	170°(77°)	200°(93°)
Magnesium Sulfate	Sat'd	170°(77°)	200°(93°)
Naphtha	100	120°(49°)	150°(66°)
Nitric Acid	5	150°(66°)	175°(79°)
	15	S.R.	150°(66°)
	30	S.R.	S.R.
Phosphoric Acid[1]	50	180°(82°)	200°(93°)
	80	150°(66°)	200°(93°)
Potassium Hydroxide	10	N.R.	150°(66°)
Sodium Chloride	All	170°(77°)	200°(93°)
Sodium Ferrocyanide	All	170°(77°)	200°(93°)
Sodium Hydroxide	5	N.R.	150°(66°)
	25	N.R.	120°(49°)
	50	N.R.	200°(93°)
Sodium Hypochlorite	**	**	**
Sodium Sulfate	Sat'd	170°(77°)	200°(93°)
Sodium Sulfite	All	80°(27°)	150°(66°)
Sulfuric Acid	Up to 25	170°(77°)	200°(93°)
	50	140°(60°)	200°(93°)
	75	N.R.	110°(43°)
	Fumes	210°(99°)	210°(99°)
Tannic Acid	All	150°(66°)	200°(93°)
Urea	50	120°(49°)	150°(66°)
Zinc Chloride	Sat'd	170°(77°)	200°(93°)

N.R. — Not Recommended

S.R. — Special Request (Details Necessary)

**Due to the large number of variables affecting the performance of polyester resins in this environment, we suggest that you contact the Technical Services Group of the Resin Supplier for suggestion on achieving maximized service life.

President Williams: Thank you, Mr. Osborn for your interesting and informative presentation. You have shown us a unique way of reconstructing pipelines and culverts. We thank you again.

Let's move along to our third special subject of which John Smith is the sponsor. John.

Mr. Smith: Thank you, President Williams. I am very pleased to introduce to the audience a gentlemen that has been a friend of the railroad industry for a great number of years. He's a friend of many railroaders. Mr. Parker has been involved in consulting engineering since 1963, involving design, management of construction, and project management of numerous railroad projects such as maintenance and yard facilities, commuter rail stations, TOFC facilities, as well as studies for new regional commuter rail services and relocation studies. In addition, he has been involved in planning and designing of several rapid transit projects and is currently project manager for the Chicago-O'Hare Automated Pedestrian Way Transit System. Please welcome Tom Parker.

SPECIAL SUBJECT NO. 3

Methods of Inspecting and Repairing of Building Trusses and Other Supporting Members

Chairman: T.J. Parker, Envirodyne Engineers, Inc.

Vice-Chairman: R.R. Davis, Milwaukee Road

Committee: L.O. Bolwahnn, Milwaukee Road
R.W. Emmerich, Osmose Wood Preserving Company
J.H. Smith, Illinois Central Gulf
C.S. Yordy, Conrail

Introduction

One of the non-ending dilemmas which confront management and those of us engaged in the construction aspect of railroading and/or general construction is the decision to retain a structure versus replacement of that structure with a new facility. In some cases these choices are limited solely to retaining a structure primarily due to lack of adequate capital funding being available even though the simpler solution may be replacement. On the other hand, is the simpler solution the most cost effective way even though sufficient capital funding is available?

In recent years, we have seen many facilities revitalized and/or converted to new uses by entrepreneurs who have exhibited that special "inner vision" necessary to develop these facilities into revitalized and/or converted uses, effectively extending the life cycle of the structure. Often, many of these structures had been considered useless or beyond reasonable cost effective repair without benefit of an indepth evaluation and analysis of alternatives.

In 1983, a Special Committee report was presented to this body concerning *"Recycling Old Buildings." In that committee report several excellent examples were provided where new uses or revitalized uses were found for structures that had been abandoned or for all practical purposes had outlived their intended use.

Many articles written about rehabilitation work have emphasized primarily the architectural solution providing limited, if any, insight into the structural aspects of the work. For the average non-professional or corporate decision maker little knowledge is gained of the whole picture of rehabilitation work and how through simple corrective measures, a building's usefulness may be retained for many years thereafter.

---

*Proceedings of the Eighty-Eighth Annual Conference of the American Railway Bridge & Building Association.

In today's business climate of high interest rates and building costs, railroad companies are being forced to re-evaluate their thinking concerning their existing physical plant and to consider various alternatives and means to extend the life cycle of that facility. In some cases, due to corporate neglect and/or lack of sufficient capital, facilities have deteriorated well beyond any reasonable cost efficient means to maintain them. On the other hand, many management staffs have been forced, through the years, for various reasons to seek ways to best utilize their facilities simply by correcting and/or repairing major problem areas. In this report, we will focus attention on one aspect of the rehabilitation process which, in many facilities, is the single most important area of the overall rehabilitation process. This particular topic is the building truss and its supporting members.

Data Gathering

As in any successful business strategy, it is important to know as many facts about a particular problem as is possible prior to taking any action. In this respect, collecting as much available existing information on a building structure should be the first step in any planned rehabilitation project. This data gathering must be as extensive as is possible in order to develop a thorough understanding of the structure and how its uses and/or changes have evolved to date.

After all available data has been assembled, it is important that time be devoted to familiarization with the material. Once an understanding of this data has been achieved, the next step should be the field inspection.

Frequently however, due to neglect, misplaced or lost information, vital data pertaining to a structure is often unavailable, or in such poor condition its use is no longer practical. In this event, a whole new approach to the data gathering process must be employed. This approach, if properly undertaken, will then provide, at the minimum, a base for establishing a new set of record documents.

Inspection

One of the most important steps in rehabilitation work is the field inspection. The team or person delegated the responsibility for the inspection should be knowledgable in their discipline and, if possible, have a good understanding of construction practices. Through utilization of the drawings, sketches, and other data gathered in the previously described step, a detailed inspection must be made of the building and its supporting structure. Variations in layout, equipment arrangements, and new features of the building which may have been unrecorded must be recognized and noted in order to properly evaluate and prescribe an acceptable method of rehabilitation. Of significant importance, the inspection team must carefully check the structural supports and framing system, noting ech member's compliance with the existing design and any deviation either in form and/or placement. Equally important, careful attention must be paid to new loads applied to these members which are not recorded upon the record documents.

Further, each supporting member and truss should be checked for evidence of decay, abuse, or other strength reducing condition. Spot checks should also be made of the different truss member pieces in order to verify size, connecting bolts, and/or plates. Additionally, a spot check should be made of the overall length of truss and depth. Unusual bending, warping, and/or deflection should also be noted.

Photographs of the building, structural supports, and trusses should be taken in general and also at key locations to serve as a memory refresher and record when developing a report or when preparing modifications to the building. In addition to these general type photographs, special photographs should be taken of significant defects and conditions which ultimately must be corrected.

In some cases, a field inspection may necessitate substructure investigation, and in these instances use of excavation equipment may be necessary to afford the inspection team full visual access to the substructure supporting system.

As mentioned earlier, some assignments may lack record documents which can be useful in the inspection process. In these cases, sufficient detailed information such as member size(s), type, dimensional data, and type of substructure support, including overall building dimensional layout should be gathered to properly define, assemble, and prepare working documents in support of any study and/or report.

In either of the above described situations, at the completion of the field inspection, sufficient material should have been assembled to permit a thorough review and evaluation of the building and its supporting structure, including any special and/or significant problem areas.

Data Assimilation

Upon completion of the field inspection, all notes, drawings, sketches, and photographs should be compiled into a single document. A listing of major problem areas identified during the inspection should be compiled along with any significant variations noted which spotlight specific differences between the original drawings and what the inspection team's findings were. From this compilation of data a comparative review of the original drawings can be made and revision, if necessary, made to the original drawings in order to reflect current conditions.

After completing this work, these two documents will be available to the design team to assist them in overall planning of the proposed work and/or remedial measures required to correct defective components of the building.

Analysis

In this phase of the work, it is of paramount importance that the design team determine through its structural evaluation, the necessary remedial measures and/or limitations that will be imposed upon any plan of rehabilitation and/or conversion.

A careful and concise evaluation must be made not only of the supporting members but of the trusses employed throughout the structure. Questions must be resolved satisfactorily regarding continued use of the facility as is or in a converted use and how repairs to the supporting members and trusses may be made in a satisfactory manner which will guarantee continued long term safe use of the facility.

Limitations of the structural supporting members and trusses must be defined and the design team advised of any limitations which may be imposed. Similarily, through this structural evaluation a determination should also be made of (1) the adequacy of the supporting members, (2) the need for reinforcement and/or replacement of selected member(s), (3) the adequacy of the present truss or trusses, (4) the degree of repair required for a given truss or trusses, (5) a value judgement concerning repair versus replacement, (6) alternative solutions which will ultimately accomplish the same goal, and (7) estimates of cost for the best solution and, if possible, an alternative solution.

Recommendations

The final stage of this evaluation and analysis program is the recommended solution to the problem. In preparing a recommended procedure for rehabilitation, the design team should explore any feasible alternative in terms of effectiveness, long term results, and cost efficiency. The recommendations presented to management whether oral or written should be as objective as possible providing not only the preferred solution but at least one or two alternative solutions as well which can produce the same satisfactory type results.

With this type of approach, management is afforded a considerable degree of flexibility in determining its options and will also allow them greater latitude in preparing any long term planning for continued use of this facility or eventual replacement.

Case Studies

In the following portion of this report actual projects are represented wherein careful preliminary studies were made, goals defined, and solutions rendered which can be attributed directly to the success of these projects.

Track Equipment Repair Building

In early fall of 1982, employees and building and bridge (B&B) personnel notified the engineering department that the building's structural system appeared to be under considerable stress. The reports received indicated that the building had been developing unusual sounds, interpreted as movement, that noticeable gaps had developed in joints of the timber trusses, and that several tension rods appeared to be hanging free.

From these reports, four basic assumptions were made which could be attributed to this condition:

1) general structural deterioration due to age and moisture infiltration;

2) weather conditions resulting in unusual loading conditions;

3) excessive loading of structural elements;

4) failure of basic building elements.

The building in question had been constructed around 1900 as a wood frame structure with heavy timber Howe type trusses and is 60 foot wide by 352 feet long. The level of activity within this building has been closely associated with the economic conditions of the railroad and has fluctuated significantly over the last 20 years. At times, the building was to be vacated and operations consolidated into another building. At other times, only minimal repair programs were conducted within the building of such a small scale that ordinary heating of the building could not be justified. As a consequence of these fluctuations and the uncertainty of the future of this building in the overall railroad's planning, only minimal inspections and repairs were carried out.

A search of the record files for drawings of the building proved fruitless, and an immediate inspection of the facility was scheduled and a team dispatched to the facility to conduct a thorough visual walk through inspection. The walk through inspection confirmed that reported gaps in the timber trusses were accurate and in several cases significant. Also, tension rods were indeed loose and were not performing their intended function. In addition to these observations, it was noted that several monarail/hoists (one ton capacity) had been attached to the underside of the trusses, and that jib cranes (500 pound load capacity) had also been mounted upon several columns. From these observations it became increasingly evident that loads were being applied to the structure in excess of its intended design.

Other building elements were also checked such as the roof, exterior walls, and foundation. The exterior walls exhibited evidence that they were no longer plumb. A closer inspection of these walls and supporting foundation found that the walls' heavy timber sill plate and stone foundation walls had evidence of decay at several locations.

From these initial observations a second inspection trip was scheduled in order to conduct a more thorough and detailed inspection.

For the detailed inspection, scaffolding was used to afford the team access to the trusses. With the use of hammers, sharp probes, tape measure, carpenter's level, and marking crayons, joint gaps, cracks, and separations were marked for future reference and measured for record purposes. Hammers were used to identify ''soft'' areas in main frame members and sharp probes used to determine actual depth of softness. A carpenter's level was used to spot check each bottom chord of a truss in order to identify unusual ''non-level'' conditions. This detailed method of inspection revealed two significant findings: (1) that previous reparis, as evidenced by spankers, had been made already to some trusses, and (2) that rusty vertical truss support rods were transmitting moisture to the weakest point of the truss.

From this accumulation of data, some immediated measures were taken in order to prevent any further deterioration of the structure which might result in personnel injury. These measures were to prohibit further use of the monorail/hoist; directing the division engineer's office to establish key elevations at end and center points of each truss in order to establish record elevations for future comparison which may indicate further movement, and, ordered each building column to be checked for plumbness along their respective X and Y axis. As a result of these last two instructions, it was found that several columns were out of plumb by as much as three inches.

From the assembled field data, drawings were prepared of the building (Exhibit A) and a typical truss (Exhibit B), and a structural analysis was performed on the truss to determine the type of forces present, noting those members which exhibited the largest forces in compression and tension.

With the assemblage of information now at hand, alternative solutions were evaluated to determine the best method(s) to halt further structural deterioration. Among the list of various alternatives considered were such measures as reducing the overall truss span length by introducing new columns along the bottom chords of the trusses; tightening truss joints by jacking trusses into their proper elevation and retightening tension rods; adding plywood gusset plates at the weakest joints to halt further movements, and, applying timber or steel spankers along bottom chords of the trusses.

The final solution selected was ultimately determined on the basis of management's desire to minimize costly repairs due to the uncertainty over retaining this facility in the railroad's short or long range planning. Subsequently, a decision was made that the repairs must be capable of sustaining the facility for a minimum of at least one full calendar year.

Based upon this decision, planning efforts were directed toward achieving a low cost solu-

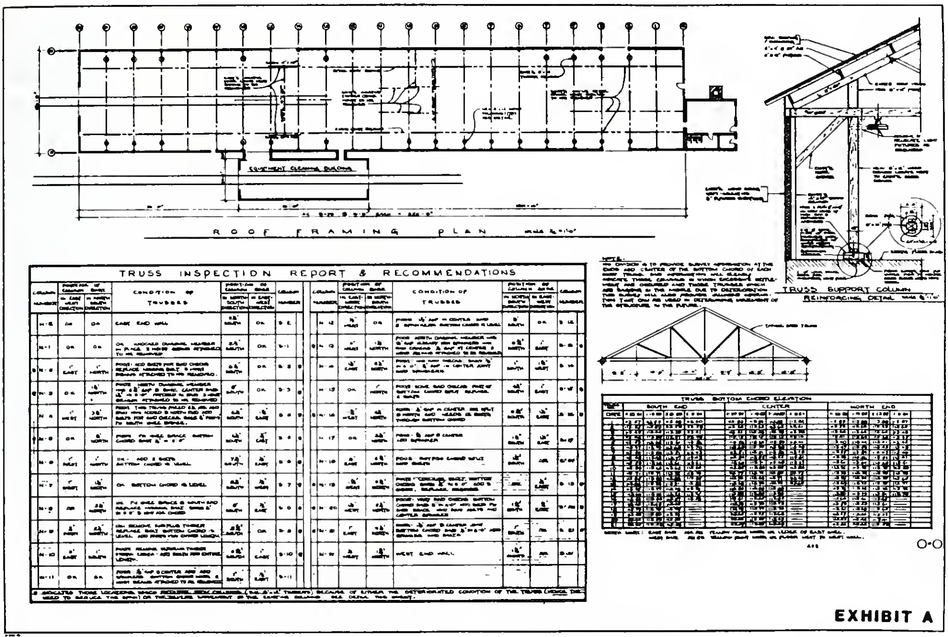

ROOF FRAMING PLAN
TRUSS INSPECTION REPORT & RECOMMENDATIONS
CONDITION OF TRUSSES
TRUSS SUPPORT COLUMN REINFORCING DETAIL
TRUSS BOTTOM CHORD ELEVATION
SOUTH END
CENTER
NORTH END

EXHIBIT A

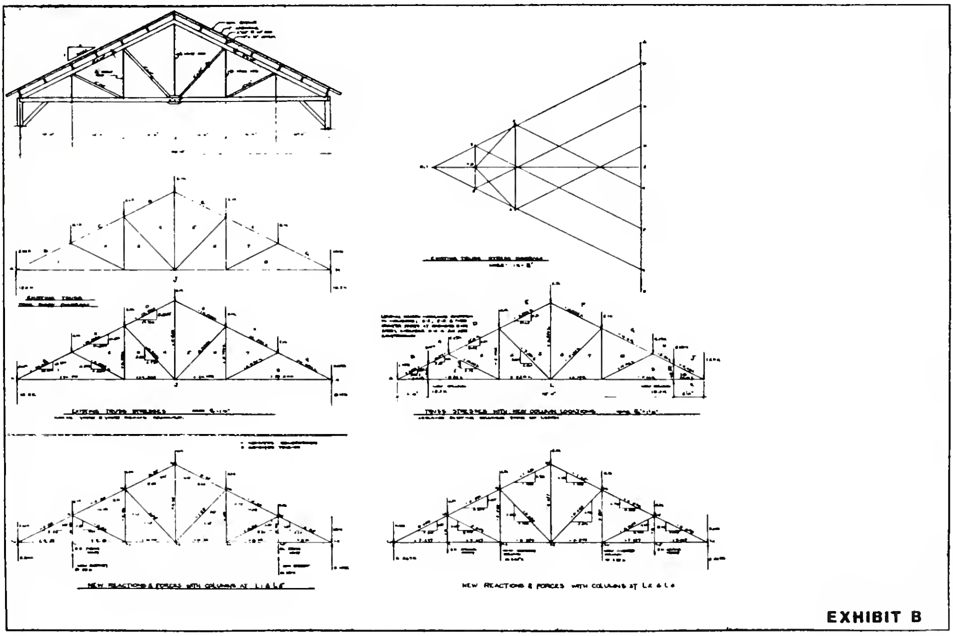

NEW REACTIONS & FORCES WITH COLUMNS AT L-1 & L-5
NEW REACTIONS & FORCES WITH COLUMNS AT L-2 & L-4

EXHIBIT B

tion which when completed would render the desired results. To accomplish this goal, a specific design was developed which would achieve the intended goal in the most cost effective manner.

The design solution which was decided upon required that an attempt be made to raise the trusses, where possible, by jacking, in order to tighten joints to their original design; add spankers to bottom chord joints that appeared to have separated; introduce new timber columns six feet inside of the existing columns, at selected locations, where column movement was considered to have had an adverse effect upon the trusses; extend these new columns above the bottom chord to the underside of the roof framing in order to transmit roof loading directly to these new columns; and, construct concrete column bases for each new column upon the existing shop floor, so that transmitted loads could be disbursed over the entire floor.

By implementing these measures and prohibiting use of the monorail/hoist it was felt that the desired results could be achieved in a satisfactory manner.

Since completion of these repairs two annual verification surveys are made to check for further movement and/or irregularities. Except for human error in data recording, no discernable movement has been noted and the facility has remained in use well beyond the one year minimum requested by management.

Roundhouse Facility, Memphis, Tennessee

Inspection reports indicated that this vintage 1913 roundhouse structure was suffering from major distress. Remedial repairs and minor periodic maintenance repair efforts had maintained the building operational for its approximate 70 year life. Recognizing that major problems were developing, the facility was budgeted for an engineering study and subsequent major repair work by building and bridges personnel in 1982/83.

The original roundhouse numbered 50 bays whereas only 20 bays existed at the time the study was commissioned. The following areas were considered major item of concern:

a. general structural deterioration throughout;

b. degree of decay/weathering of building structural components;

c. excessive loadings from shop built craneway systems, elevated piping, etc. added to the structure over the years.

A search of drawings and other records for this building proved fruitless, prompting a need for an immediate inspection trip to physically determine the degree of structural decay. From field observations, it became apparent that the presently applied loads from various craneway systems and pipe lines were seriously overloading the capacity of the decaying structural members. During the field inspection, it became apparent that the original capacity of these structural members had not been designed to accommodate the additional loads applied.

Inspection of the major roundhouse structural components was accomplished by use of a hydraulic hy-lift bucket to allow close visual inspection and testing of all members. With chisel, hammers, levels, plumb bob, crayons, 100-foot steel tape, and notebook, all structural members were thoroughly checked, identifying clearly all decayed areas and soft spots. Drift and level of all members were also checked and identified in the report.

Other building elements were also inspected such as the roof, exterior masonry walls, columns, and foundation walls. Earlier tuckpointing of the exterior walls had helped to extend the life of this building. The built-up roofing system had just recently been replaced on solid and renewed decking, including decayed roof joist and/or purlins. No extremely severe conditions had been found in either the building columns and/or exterior walls and foundations.

As is usually the case on most railroads, a maximum effort was made using sound engineering judgement to identify a plan, in report form, which would minimize costs and rectify situations such as described above. On the strength of the report, authorization was obtained to replace those members where accessible and to modify those decayed structural members as dictated by conditions conducive to sound engineering practice. All recommended repairs took into account both present and future anticipated design loads.

It was determined, that raising the various roof sections by jacking would be cost prohibitive and time-consuming (other constraints we find in today's environment in daily work) and therefore, it was decided to clad each structural timber by emplacing structural steel channels on either side of a member and steel angles with threaded rods to tie the channels to each member.

Some columns required only partial replacement inasmuch as decay was found to be localized at the bottom three or four feet of certain columns. Column repairs were accomplished by cutting into solid wood above the portion of decay, removing the decayed area and then replacing these areas with tight fitting wood pieces of similar dimension. Fortunately, all interior timber columns were healthy enough to require only minimal repairs.

Since completing all work no discernible movement or irregularities have occurred, and this renovated roundhouse should continue to provide several more years of service requiring only minimum preventive maintenance.

President Williams: Thank you, Mr. Parker and your committee for a fine and informative report.

Our fourth and final special subject report will be introduced by its substitute sponsor, Ray Tallent. Ray.

Mr. Tallent: The title on the last talk is "Vandalism to Tools and Buildings". It's unfortunate we have to have a special subject with this title, but it seems that we are having more and more vandalism ranging from constructions sites to maintenance equipment, and it's hard to leave anything along the right-of-way that doesn't get damaged. And this isn't only in the big cities, but also in the rural areas.

Ronnie Patton, B&B supervisor from the Southern Railway, is Chariman of this report. Ronnie was born in Huntington, Indiana, and joined Southern Railway as a B&B apprentice in 1976. Since that time he has been promoted to assistant B&B trainee in Birmingham, Alabama, in August 1977, and he has held positions as B&B project supervisor; assistant supervisor in Louisville, Kentucky; and is presently B&B supervisor in Princeton, Indiana. Ronnie.

SPECIAL SUBJECT NO. 4

Vandalism to Tools and Buildings

Chairman:	R.D. Patton, B&B Supv., Southern Railway, Princeton, IN
Committee:	N.D. Bryant, Asst. Chf. Engr., Burlington Northern, Overland Park, KS W.G. Dahlin, Supv. B&B, Burlington Northern, Billings, MT P.P. Anderzunas, Asst. Divn. Engr., Conrail, Mont Holly, NJ H.E. Wiebler, Wk. Equip. Mtr., Toledo, Peoria & Western, Peoria, IL

The report of the committee on Special Subject No. 4, "Vandalism to Tools and Buildings" was compiled from information and experiences of members of various railroads in the United States. Vandalism as defined, is to destroy or damage maliciously. It is a major problem for the railroad industry, however, we can take preventive steps to detract the problem. Let's take a look at the subjects in detail.

Buildings

We will discuss two areas in regard to this subject, buildings in service and new construction. Buildings in service can be renovated in several ways. To protect the window, one railroad uses a 10-gauge, 1½-inch diamond mesh screen, steel bars fabricated to cover the frame on wooden structures, have been very effective. Metal doors with deadbolts have been more effective than wood on older structures. One railroad bolts a metal box on the center of the wood door which stores a key for the deadbolt. On the exterior of the box is a warning, "DANGER — HIGH VOLTAGE." This has been extremely effective since introduced by railway police and special service. Remodeling and removing doors and windows was successful for one railroad as depicted in the following slides:

This is the front of the building. New tin is where windows were removed.

This is the side of the building showing number of windows removed.

All windows have been removed, ventilator installed, as welders work in this area at the rear of the building.

This is lockable storage and beam, one ton hoist used for light lifting.

This is a small work area which leaves drive clear.

New construction is designed to be maintenance free by use of concrete blocks and bricks on the exterior of buildings along with metal doors and frames with non-removable locks. Good lighting of area around buildings and security fences are good ways to detract vandals.

Security of Tools

Protection of B&B gang tools from vandalism and/or thievery is a major problem. Due to remote locations of structures, tool boxes are used for storage of tools at the job site. There are two railroads which use a large steel tool box affectionately called the "vault" by bridge gangs. The tool box was designed and built for a railroad in 1982. This vault was introduced to another railroad in 1983 and they placed an order for 12 of the tool boxes in early 1984. Their bridge personnel liked the vaults so well they placed another order for 14 additional ones during the fourth quarter of 1984. Now tools and small equipment can be left at the job site where formerly it had been necessary to haul them to and from tool containers or gang trucks each day.

For example, in Cicero, Illinois, until introduction of the vault, no tools or equipment could be left in the standard tool box. To date, there haven't been any forced entries in this type tool box on the entire railroad in the years they have been in use. The dimensions of the vault are 4 feet by 4 feet by 6 feet high, with approximate weight of 2000 pounds. Therefore a prerequisite for using the vault is a crane or hoist. The primary use was for construction gangs and bridge maintenance gangs outfitted with equipment to handle the load.

Another example of vandalism was the use of a wooden tool box which was whittled around the hinge area and locks shot off by a gun. One railroad uses a Knaack tool box as depicted in the following slides:

This is a Knaack tool box and small storage under bed.

This shows where padlock fits and cannot be removed unless a key is used. Locks are on each of the box.

Tool box and brackets available for tool storage on the beam, notice no lock on the box.

Summary

There are a number of different types of tool boxes on the market, ranging from steel to concrete. Through innovative efforts we can design and build boxes which will secure our tools and small equipment and suit our needs.

President Williams: Thank you, Ron, for your interesting report. All of us line supervisors have run into these types of problems.

This completes our separate B&B Session. I want to thank you for your attention and remind you that copies of our special subject reports are available at the rear of the room.

Please remember that tomorrow's joint session will be starting at 8:30 a.m. in the Reunion Ballroom of the Hyatt Regency. Also, remember to fill out a special subject card for next year's reports, and turn them in at the registration desk.

If there are no further questions, this session stands adjourned.

THURSDAY MORNING

September 19, 1985

The Thursday morning joint session was called to order at 8:30 a.m.

President Staplin: All please be seated. The third session of the Roadmasters and Maintenance of Way Association and the American Railway Bridge and Building Association will now come to order. Ladies and gentlemen, members and guests, on behalf of the Roadmasters and Bridge and Building Association I welcome you to the third joint session of this conference. Registration as of this morning is 672 Roadmasters; 138 Bridge & Building; 1,209 guests for a total of 2,019 railroads and also we have 482 ladies for a grand total of 2,501. It is most gratifying to see this kind of a turnout here at Dallas. We surely hope that everyone has had a good time and benefitted from it.

I would like to take just a couple of minutes of this time to make one or two remarks. Due to the hurry up to finish the crowded sessions yesterday I deferred my remarks until today. There are two or three things I would like to mention as far as our Association, and I think the same thing goes for the Bridge and Building Association, but I'm going to address my remarks to the Roadmasters specifically.

One has to do with participation in our committee format. As you all know, we select subjects for the coming year to be reported on, and each subject is assigned a chairman and co-chairman who generally prepare a questionnaire and send it to people who volunteer to answer questionnaires for that specific subject. Sometimes the sign-ups are pretty good, and sometimes they're not. We need peoples' opinions on subjects. When I say opinions, I mean just that. Often in the office I see questionnaires come in from our field people who will say "Well, I'm not an expert, so I'll send it to the general office, because I know somebody up there who is an expert in answering this particular question". I'm not sure that is what we are really looking for in every case. When you get a questionnaire there may be things that are pertinent on there to your experience of which you have wide knowledge. There may be things of which you don't have a whole lot of knowledge. There is nothing that precludes simply indicating in your answers the areas in which you would be a little weak; those you can just defer, but on the ones in which you're fairly strong go ahead and answer it.

The second thing with these questionnaires is that sending them to the general office may get them around to somebody who has got perhaps more technical experience, but in many cases roadmasters and general roadmasters and track supervisors who get these questionnaires have valuable opinions to offer, and, I think, as we all know, there is an occasion or two when the opinion may not be quite consistent with company policy. These are anonymous questionnaires. Let me give you an example of what I'm talking about. I think we all probably feel like we're overburdened with paperwork, but most of our companies have a lot of paperwork, so, if you had a questionnaire on paperwork, I think you would be free to express your opinion about the volume, whereas the company policy seems to be able to create more. But what I'm saying, I guess, is the roadmasters, general roadmasters and track supervisors, general division engineers, and division engineers, the people in the field — their opinions should be valued, and to those of you out there who occupy these types of positions, I would say go ahead and give it your best, and by all means do sign up for committees to answer questionnaires or even chair one of these committees.

There were two speakers I think yesterday who indicated that there is a large value in this participation. I know at the Seaboard we try to make it a policy. We're limited like everybody else, especially in air travel, in sending people to these conferences. But we pretty much tell anybody who wants to participate that we can almost guarantee that those folks are going to get to go to the conferences. One of the complaints that we do hear, which is a valid one in these economic times, is that "Gee whiz, I don't know if I want to participate because I don't get to go." Well, I think participation is one of the sure ways to go. More importantly, I think it is a valuable professional experience.

The second thing I would like to touch on for just a minute is the condition of the Association. I think we all remember a year or two back when there was a lot of controversy going on about AREA and Roadmasters and B&B, and I still occasionally hear statements to the effect "Well, are you guys solvent, are you going to make it?" And let me assure you that the Roadmasters Association, has never been stronger. We've taken some steps in the past several years to begin to understand how revenues and expenses flow, and that's not easy, because our bills don't always come due in the same year that we incur them, and we have to pay them in 1985, but we incurred them in 1984. It's difficult to keep track of the finances, but we've set up a system in the Roadmasters now where we can project ahead, and we've a revolving five-year forecast which is based on membership and projected attendance at conferences like this. We think with this system in place, that we can make a pretty good projection, for example, when we might have to consider a dues increase or a registration increase, rather than having it come up almost overnight, with the realization that because we're a little short of money we'd better raise the dues or something. We think, with better planning, that from our standpoint the Roadmasters is strong and will continue to remain so.

We've also taken over the handling of the advertising in conjunction with the B&B. We're taking over in the office of the Secretary the advertising in the Proceedings. Thirty-five percent of the revenue used to go to the ad agency who worked for us. There have been questions from time to time as to how hard he was working for us. But he never failed to get his 35 percent. I think in some cases he did a pretty good job, but we feel that we can handle it in-house. It will put a little extra strain both on the board members and on the office, because we now have to do a little more work towards solicitation than we did before, and there's more paperwork for Pat and Brenda to handle. But we think by doing that, we'll get a bigger slice of the revenue and, we hope, come out stronger for it. As I've also said yesterday we're going to make a constitutional change. We hope that it will be voted on at the next Technical Conference in Chicago. It has to do with permitting the Board to set the location of meetings outside the city of Chicago. Our constitution provides that those meetings, except in case of emergency, will be held in Chicago, and I think the strong attendance here is evidence to the fact that there are a lot of good drawing locations outside the city of Chicago especially with many of the railways now having headquarters in places like Atlanta, Philadelphia, and Kansas City. There are a lot of major railroads now out of Chicago. So the compelling reason we used to have to go there, which was the fact that it was a total rail hub and had probably the highest employment of railway professionals, is no longer quite valid. Also, in many cases, when we go outside Chicago we get better deals as far as hotels and other arrangements are concerned.

That leaves me with a final remark I would like to make. Most of the things that have been done in my tenure on the board and this year as President have related to the administration of this Association. I hope it's better for it, and it has been a rewarding experience for me. But I think for the future, there is a challenge to the incoming board and president to re-examine and strengthen the mission of the Roadmasters which is to improve the professional level of middle and lower management professionals in the railway maintenance of way industry. And I'm referring to perhaps the strengthening of the concept, perhaps even a change of the concept, of the type of reports that we do, the type of information we disseminate. We need to re-examine our roll because the need for training and information on best or better practices has never been stronger. I think in our industry there are a good many young roadmasters who have progressed through the ranks into roadmastering, general roadmastering, and in track supervisor ranks who haven't had the benefit of the optimum training level. So the mission of the Roadmasters fills a need, and I hope that that mission will be strengthened in the future.

At this time I would like to present our plaques to the outgoing directors of the Association who will be completing their term this year. Because we are renominating Hugh Fuller, we'll make him wait three more years for his plaque, but there are a couple other gentlemen whom we would like to honor at this time. John Smith. I would like to read you this plaque. It says, "Appreciation Award Presented by the Roadmasters and Maintenance of Way Association of America to John Smith for his services as Director 1981 to 1985." John had a difficult job this year with the subject committee reports that he chaired. That's one of the most difficult jobs on the board and he did it well. Thank you, John.

(Applause)

Mr. Smith: Thank you.

President Staplin: A second plaque we would normally have distributed to Mr. Kelley of the Seaboard. Mr. Kelley had to attend a meeting in Jacksonville today, so he won't be with us. At this time I would like to turn the podium over to Jim Williams of the Bridge and Building Association.

President Williams: Thank you, Dave. Ladies and gentlemen. I can't say much more. It's been a terrific conference from what I could see, and I've talked to people from REMSA, and they seem satisfied, I've heard favorable comments on our program and the committee reports. I would like to thank the Executive Committee and members for all the help that you have given me throughout the year.

At this time I would like to give our three outgoing directors their plaques. I'll read the names: Don Ladner, Director 1982 to 1985; Tom Kuhn, Director 1982 to 1985; Ray Tallent, Director 1982 to 1985. With that, I'll turn the rostrum back over to Dave.

(Applause)

President Staplin: At this time I would like to call on Ken Welch who is our Program Chairman to present our special feature of the morning.

Mr. Welch: Thank you, Dave. This morning we've got a presentation by Vince Mahon, who is the Department Manager of Power and Way Maintenance with Bay Area Rapid Transit. Vince has a rather unique background as far as members of our organization go. He worked for 19 years with the Southern Pacific in basically track areas, did a lot of moving around as most of use do. But then in 1968 Vince was approached with the opportunity to get involved with the design and construction of BART. Vince is also Chairman of the American Public Transportation Authorities Equipment Committee, and Vice Chairman of the Track and Structures Committee. Without further ado, here's Vince Mahon.

Track Rehabilitation and New Construction in an Operating Environment at BART

by Vincent P. Mahon

Department Manager, Power & Way Maintenance

(Slide Illustrated)

In order to better understand the magnitude of construction and technical involvement, I will briefly describe the BART System.

The San Francisco Bay Area Rapid Transit District (BART) is an electrified high speed rail rapid transit system with 150 miles of double track covering a three county area. One hundred nineteen pound continuous welded rail is used throughout the system, with approximately 50 miles of the mileage constructed on concrete slab in underground subway structures (underwater tube, driven ring section, and cut-and-cover), 50 miles are constructed on second pour concrete slab on elevated structures, the remaining 50 miles being constructed at grade on ballast section using concrete ties. BART is a 66-inch wide gauge system with trains operating at speeds up to 80 miles per hour. Maximum curvature is 450 foot radius curves with an 18 miles per hour civil speed limit in these areas.

Present Operation

BART operates a 20-hour per day, seven day weekly schedule. In June, 1985, our daily average passenger load was 213,300 patrons. For the same period, our average weekly passenger mileage was 2,758,400 miles.

We currently operate on 3.8 minute headways during our peak commute period, and on 20 minute headways during our lowest demand periods. The train speed and spacing is electronically controlled by automatic train control (ATC) equipment located in each passenger station. Coded audio frequency signals are coupled to 1050 track block circuits and transmitted to the train's on-board automatic train operation (ATO) equipment. Train operations are supervised and controlled from our central control center at Lake Merrit.

Currently we operate a maximum of 43 trains on the system at one time. The BART five year plan calls for increasing the capacity of our system to 57 trains by the year 1989/1990 with the capability of handling a maximum of 75 trains as may be required in the future.

Projects in Progress

In order to accomplish this goal, engineering studies pointed out the need for the following four major projects which are now in progress:

1. A higher capacity central monitoring and control computer system to support the increased service demands;
2. The addition of 150 revenue cars to our rolling stock fleet;
3. Construction of a fast turnback and yard facility at our west most terminal area, Daly City station; and
4. Construction of an express track through the "Downtown City of Oakland Wye" junction — a physical bottleneck to any increased level of service which I will now illustrate to you in detail.

Construction Procedure

With the installation of the first piece of new mainline track and switches by district forces in April, 1980, phase A of the long-awaited KE track was officially underway. The construction of the three-mile, $26 million project includes the installation of 17 mainline switches and all associated third rail and automatic train control equipment beginning just south of MacArthur Station, extending through the Oakland Wye, and converging with the two existing main tracks near the Oakland West Station. Eleven of the mainline switches consisting of No. 10's, 15's, and 20's were installed by power and way maintenance department employees. This was done to eliminate the contractor from working in or about operating main tracks. All contractor work is confined in the fenced areas for safety reasons.

To expedite construction, the project was divided into three phases — A, B, and C. Phase A was the construction of the subway portion of the project from Washington Street Portal to the 23rd Street Portal including station finish at the 12th and 19th Street stations. The first 1½ miles between Oakland West Station and 23rd Street Portal were completed in January, 1982, and was put into service for storing of bad order trains.

Phase B consisted of the installation of eight mainline switches and all associated electrical and underground work. The reach of this project extended from the 23rd Street Portal and ended just south of the MacArthur Station under the State Highway Interchange Network. This work was accomplished in a joint effort using BART personnel to install the switches in the main track and contractor employees doing the fabrication of switches for mainline installation and all associated underground work. All work was performed under the direction of BART power and way maintenance department supervisory personnel.

Project Protection

All track work and underground installation in Phase B had to be accomplished between 2200 and 0145 hours and during system downtime of 0145 and 0445 hours each day. In order to accomplish the work during this time frame, it required precision scheduling, unique flagging innovations in an automatic train control system, and close coordination and cooperation between central control operations and the power and way control center in order not to interfere with revenue train schedules.

To properly protect crews in accordance with the BART Operations Rules and Procedures Manual, zero speed commands were initiated at the wayside mux box. This forced all trains operating in an automatic mode to stop within 1,000 feet of where crews would be working. This forced the train operator to run through the affected blocks in road manual mode being prepared to stop on signal from crews. Upon the train reaching the end of the restricted zero speed code blocks, the operator then returned to the automatic mode at a designated milepost location. This specialized flagging would go into effect at 2200 hours each night and expire at the end of revenue service. When it was necessary to single track through the work area, ''route prohibits'' were established in the train control room by train control personnel forcing trains to run in the automatic mode on the opposite track throughout the work area. It was also necessary to have electrical crews establish third rail safe clearance in the work location area.

Underground work in between the two main tracks required a considerable amount of excavation. You will note the extensive reach of the underground for electrification.

In many locations, the installation of runs for train control cabling were made as shown adjacent to main tracks. It was necessary to excavate right up to the end of ties on main tracks that were in revenue service. Relocation of drainage outlets also had to be made in between the two main tracks. Trenching and cribbing of main tracks were a common occurrence, and all excavation in these critical areas had to be properly shored in order to keep revenue service operating at normal speeds.

Turnout Construction

Upon the completion of all underground work at each switch location, switch ties were laid in place, and the switch was built at the exact location in between the two main tracks where it was to be installed. You will note in the construction of the switch that all rail joints in the switch have been eliminated. This was accomplished by redesigning and extending the heel and toe of the frogs and heel of the switch points using field welds in lieu of joint bars throughout the switch area. This change was made due to the fact the new switches were being installed in a continuous welded rail area. This feature makes the switch compatible with the welded rail environment in which it was installed, and we find that it has greatly enhanced the riding quality throughout the switch area. Bonded insulated joints were installed using Huck fasteners as shown.

All third rail insulators, track bonding, and switch machines were installed making the switch unit a complete package ready for instant installation into the main track. Prior to the installation of the prefabricated switch at the location where the switch was to be installed, the continuous welded rail was cut and short sections of rail installed. Temporary bonding was used in lieu of the Cadwell bonds for the negative return rail currents. You will note that this was accomplished by using 4/0 welding cable welded to rail anchors which made for an easy installation on and off the rail.

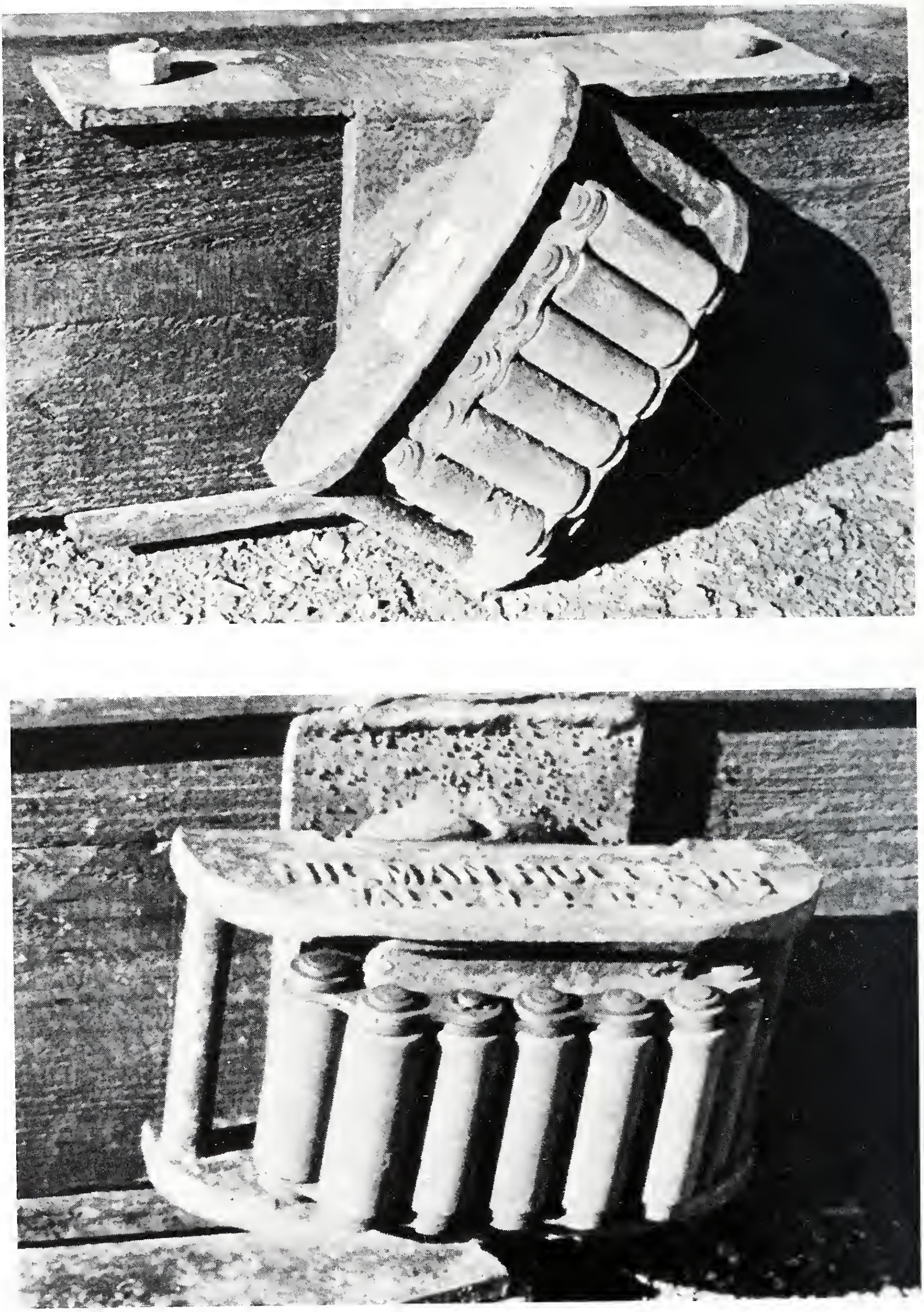
Turnout Installation

The next step was to develop and implement a plan that would allow for instant mainline switch installation, moving the entire prefabricated switch into location on the main track in the least amount of time. This was accomplished by using a unique system of rollers attached to the bottom of switch ties at 18-foot intervals throughout the switch using channel iron for the guide way. These pieces of channel iron were put into place and laid to proper grade prior to placement of switch ties. They extended from the far side of the switch through the main track and extended under the main track for a distance far enough to allow the switch to be moved into proper main track alignment. The channel irons were then covered with ballast under the main track as they were placed at grade at the bottom of the tie. Here you will see the roller installed on the end of a tie where accommodations were made for a bridle to be installed to allow for uniform pulling of the switch. The project required the installation of No. 10, No. 15, and No. 20 switches with a minimum of 128 feet to a maximum of 198 feet in length, each weighing in excess of 25 tons.

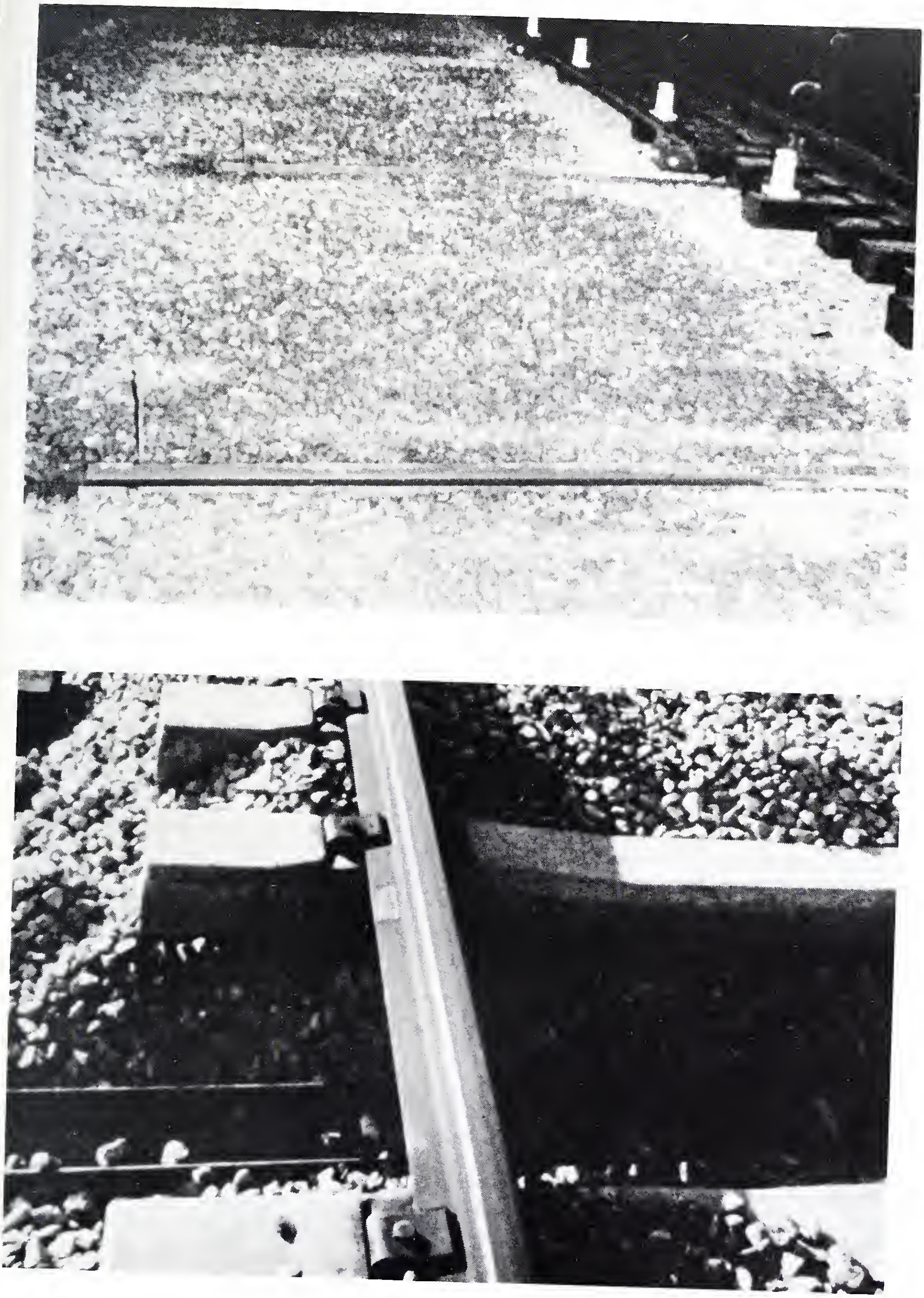
Commencing at 2200 hours on a pre-determined date, single tracking was implemented and work train and crews moved in to make the final switch installation. The purpose of pre-installing the short rails was to speed up the effort of removing the rail and ties in panels from the locations where the switch was to be installed in the main track.

The panels were loaded on flat cars and were moved to a location where a new track was to be built. The short rail sections were removed leaving the ties in place at the proper spacing. The short lengths or rail released were repeatedly used at other switch installation locations. By using this method, we were able to construct 700 feet of new track with very little effort. In this picture, you will note the train running on the new track alignment with the old main track still intact along side the newly constructed one. Using this technique we saved many dollars in reconstructing the new line.

Upon the removal of the rail panels, we used end loaders to remove the ballast and excavate three to four inches below the existing grade.



Flat Topped Chain Type
Roller Assemblies.



Roller Channel
Placement and Installation.

Here you will note the channel iron guideway being uncovered as the ballast was removed. This view is an illustration of excavating the location to the new grade. Note the channels are now exposed and the new switch is ready to be pulled into position.

Here is an under view of how the roller is to function using the channel iron as a guideway. Two tow trucks were positioned on the freeway, and cables were connected to the bridles attached to the rollers in order to pull the switch into position. A supervisor was placed in position, and he orchestrated the pulling of the switch into proper position.

The California Department of Transportation was very cooperative during the entire project, as they closed the freeway lanes as required in order for the pulls to be made from the freeway. We also developed a plan to make pulls directly from our right of way using cranes on the opposite track.

Due to the limited amount of track time available to accomplish the installation of the switch, many wayside discussions were held during the installation. The main topic of conversation was: were our calculations correct for matching up the new switch with the existing track, and would we meet our deadline for restoring the main track back to normal revenue service. Here our general manager is pointing out that we missed it by two inches. He was told that we were prepared for our shortcoming, and the crews installed rail pullers to close the joint. The actual pulling of the switch location into the main track was made in a record time of about three minutes. After the switch was pulled into proper alignment, the work commenced to tie in the ends and replace ballast with the end loaders in order to allow the tamping operation to commence as soon as possible.

Our production tamper with the electronic raising beam, switch tamper, and track liner were used to bring the newly installed switch up to proper alignment and grade.

In order to insure this was done properly, a constant survey was made of both the horizontal and vertical track alignment. Upon completion of the surfacing and alignment, the third rail was placed on the insulators that had previously been installed. A final ballast dump was made by using our air-controlled ballast cars.

When doing work of this type on a limited amount of track time, 0445 hours the next morning arrives very early, leaving no room for errors.

The crews and equipment are now preparing to leave the installation location, and the train control crew made the 200 test to ensure the automatic wayside signalling system is functioning properly.

With the completion of Phase C which included the construction of approximately 1½ miles of track tying into the switches installed by the district and the completion of the electrical and train control equipment, scheduled for December, 1985, the new CX/MX line will be put into operation eliminating the Oakland Wye bottleneck and will allow greater operating flexibility enhancing our overall system operation.

The scope and magnitude of work accomplished during this time frame could not have been completed without the dedicated effort of all district personnel involved and the use of our unique method and technique for instant track switch installation during revenue service.

Thank you.

President Staplin: Thank you, Vince. That's a pretty outstanding job under those types of conditions. Now I would like to call on John Kapp for our second special feature presentation.

Mr. Kapp: Thank you and good morning. Our next speaker is Mr. Kenneth Kulick of Amtrak. Mr. Kulick received his Bachelor of Science in Civil Engineering from the Poly Technique Institute in New York in 1970. He received his Masters of Science in Civil Engineering from the University of Illinois in 1972. At that time he joined the Erie Lackawanna as Assistant Division Engineer. He came to Amtrak in 1974 as Division Engineer in Washington, D.C. He has a professional engineering license in both New York and Illinois, and today he will be talking to us on the use of the personal computer for scheduled preventive maintenance. Mr. Kulick.

Personal Computer for Preventive Maintenance System for Buildings

by **Kenneth L. Kulick**

Division Engineer
Amtrak, Washington D.C.

Good Morning. Over the last few decades there have been significant increases in worker productivity in track maintenance due to the introduction of sophisticated production equipment.

The Problem

However, productivity increases have been harder to achieve in routine building maintenance operations. This is primarily due to the nature of building operating systems — individual units in many different locations requiring many different types of routine maintenance procedures. At this time let me define what I mean by building operating systems. Included are heating, ventilating, and air conditioning systems, elevators, pumps, fire protection systems, and shop equipment such as locomotive drop tables and overhead cranes.

In addition, many railroads have invested many millions of dollars constructing new facilities or renovating existing facilities. Too often, however, no one pays attention to the proper routine maintenance of the operating systems within these facilities. In many cases, equipment is only maintained when a failure is reported.

Computers and Preventive Maintenance

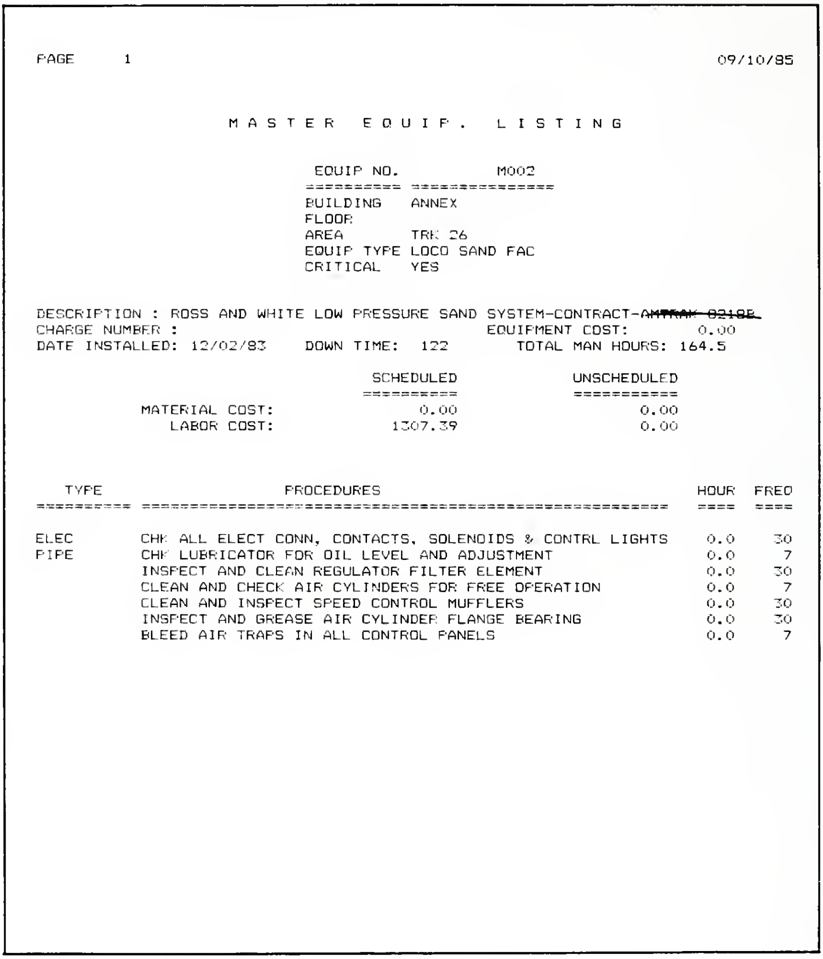
The solution to both of these situations — productivity and protection of investment — is the implementation of a well-developed preventive maintenance system. The mechanical and electrical systems in modern buildings are too numerous and complex to maintain properly without one.

The widespread introduction of personal computers in the workplace has allowed the development of computerized preventive maintenance systems that can easily be adapted to the railroad environment. The main features of any computer-based PM system are automatic scheduling of periodic maintenance tasks, generation of specific procedures for every piece of equipment to be maintained, and collection of productivity and cost data. To be effective, a computerized PM system must respond to the needs of the organization responsible for maintenance. These systems are now commonly in use by commercial and industrial building maintenance organizations.

Example Application

In my Division the immediate reason for investigating the implementation of a computer-based PM system was the construction of a new $50 million car and locomotive repair facility in Washington, D.C. A review of the design plans indicated that there would be over four hundred individual pieces of equipment in the facility that would require regular, routine maintenance in order to perform properly. A survey of the existing maintenance methods revealed a lack of standard procedures, poor or no documentation of repairs or costs, work assignments not efficiently scheduled, and a reliance on specific personnel for particular jobs because "they had been around for a long time". It was apparent that the existing system of maintenance could not and should not be applied to the new facility. It was also not reasonable to expect any individual supervisor or group of maintenance employees to be able to properly schedule that amount of work without assistance.

When the decision was made to implement a computerized PM system, several proprietary packages were investigated. Software costs ranged from $5,000 to $30,000. The higher priced systems are usually designed for manufacturing operations which require on-line, real-time systems. This is usually not required for railroad facility maintenance. We found a software package that was designed for use with an IBM PC. The system we use had a total installed cost of approximately $10,000 for soft-



```
PAGE      1                                                              09/10/85


                    M A S T E R   E Q U I P .   L I S T I N G

                                   EQUIP NO.           M002
                                  ========== ===============
                                  BUILDING   ANNEX
                                  FLOOR
                                  AREA       TRK 26
                                  EQUIP TYPE LOCO SAND FAC
                                  CRITICAL   YES

DESCRIPTION : ROSS AND WHITE LOW PRESSURE SAND SYSTEM-CONTRACT-~~AMTRAK 8218E~~
CHARGE NUMBER :                                    EQUIPMENT COST:        0.00
DATE INSTALLED: 12/02/83     DOWN TIME:  122          TOTAL MAN HOURS: 164.5

                                        SCHEDULED             UNSCHEDULED
                                       ==========             ===========
          MATERIAL COST:                     0.00                    0.00
             LABOR COST:                  1307.39                    0.00


   TYPE                        PROCEDURES                                     HOUR  FREQ
========== ======================================================             ====  ====

ELEC       CHK ALL ELECT CONN, CONTACTS, SOLENOIDS & CONTRL LIGHTS            0.0    30
PIPE       CHK LUBRICATOR FOR OIL LEVEL AND ADJUSTMENT                        0.0     7
           INSPECT AND CLEAN REGULATOR FILTER ELEMENT                         0.0    30
           CLEAN AND CHECK AIR CYLINDERS FOR FREE OPERATION                   0.0     7
           CLEAN AND INSPECT SPEED CONTROL MUFFLERS                           0.0    30
           INSPECT AND GREASE AIR CYLINDER FLANGE BEARING                     0.0    30
           BLEED AIR TRAPS IN ALL CONTROL PANELS                              0.0     7
```

ware and hardware including an PCXT with 256KB internal memory and a 10MB fixed disk. Many offices will find that they already have a computer which could be used for preventive maintenance scheduling.

Implementation

The PM software should be able to store the following: data base listing all equipment characteristics and maintenance procedures; maintenance history of all equipment; labor and material costs associated with that maintenance; and labor hours.

The key to making this type of system function effectively is employee understanding and acceptance. Prior to the start of implementation, meetings were held with all supervisors and craft workers who would be involved with the system. The reasons for the system and the benefits to the employees were explained. Some of the forms which the employees would be using were distributed. This part of the implementation is essential, for, without proper follow through and feedback from the field, the entire system becomes useless.

The first step towards implementation is a complete facility survey at each building to be included in the system. Each piece of equipment that requires maintenance must be located and described by type, manufacturer, serial number, and any other significant data. This process must be thorough — you may actually find some equipment that was not generally known to exist.

Each piece of equipment identified in the facility survey must be given a unique identifying number. Any numbering system can be used. Our system uses an alpha-numerical system in which the letters indicate the type of equipment, and the numbers are assigned in sequence.

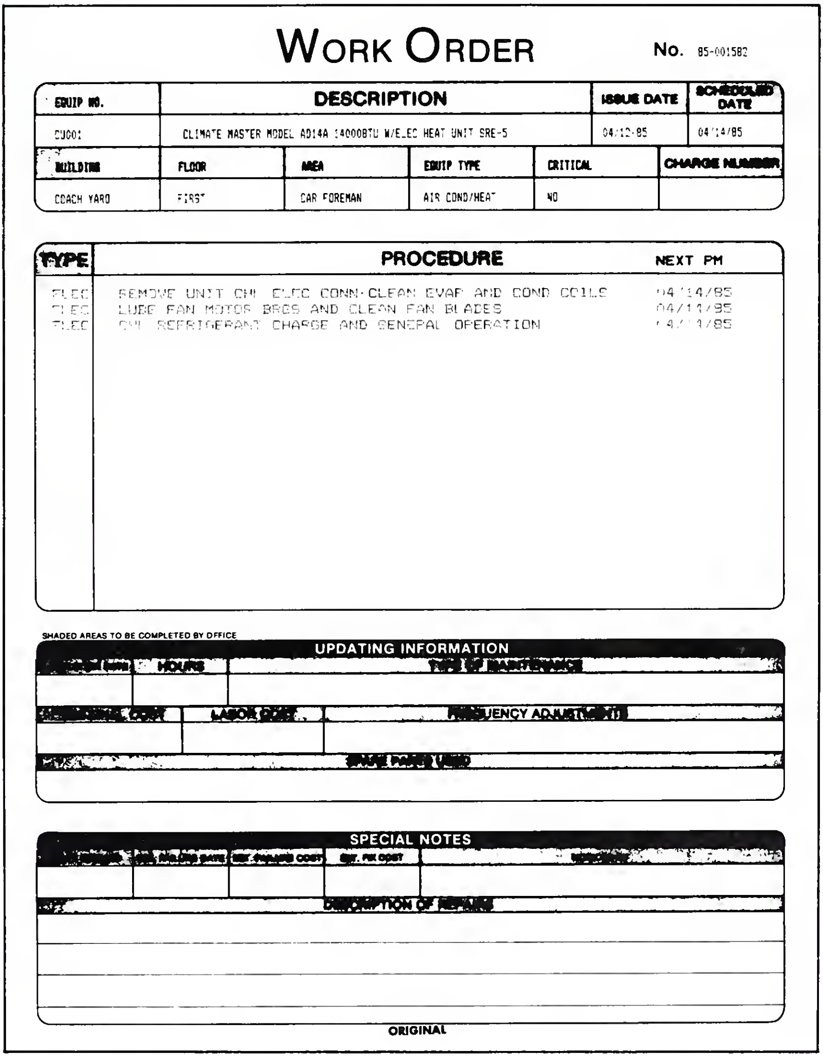
Examples of our letter code are:

AC — Air Compressor
AH — Air Handler
DC — Door Control (OH Doors)
FP — Fire Protection
P — Pump
UH — Unit Heaters

An engraved plastic tag with the identifying number is affixed to each piece of equipment in order to permanently establish its identity.

Work Order System

The next step in starting up this system is to determine the maintenance procedures to be performed, the frequency of maintenance, and what craft will perform each type of procedure for each piece of equipment. For recently installed equipment, the manufacturer's manual



WORK ORDER

No. 85-001582

EQUIP NO.	DESCRIPTION	ISSUE DATE	SCHEDULED DATE
CU001	CLIMATE MASTER MODEL AD14A 14000BTU W/ELEC HEAT UNIT SRE-5	04/12/85	04/14/85

BUILDING	FLOOR	AREA	EQUIP TYPE	CRITICAL	CHARGE NUMBER
COACH YARD	FIRST	CAR FOREMAN	AIR COND/HEAT	NO	

TYPE	PROCEDURE	NEXT PM
ELEC	REMOVE UNIT CHK ELEC CONN-CLEAN EVAP AND COND COILS	04/14/85
ELEC	LUBE FAN MOTOR BRGS AND CLEAN FAN BLADES	04/14/85
ELEC	CHK REFRIGERANT CHARGE AND GENERAL OPERATION	04/14/85

SHADED AREAS TO BE COMPLETED BY OFFICE

UPDATING INFORMATION

[illegible]	HOURS	TYPE OF MAINTENANCE

[illegible] COST	LABOR COST	FREQUENCY ADJUSTMENT

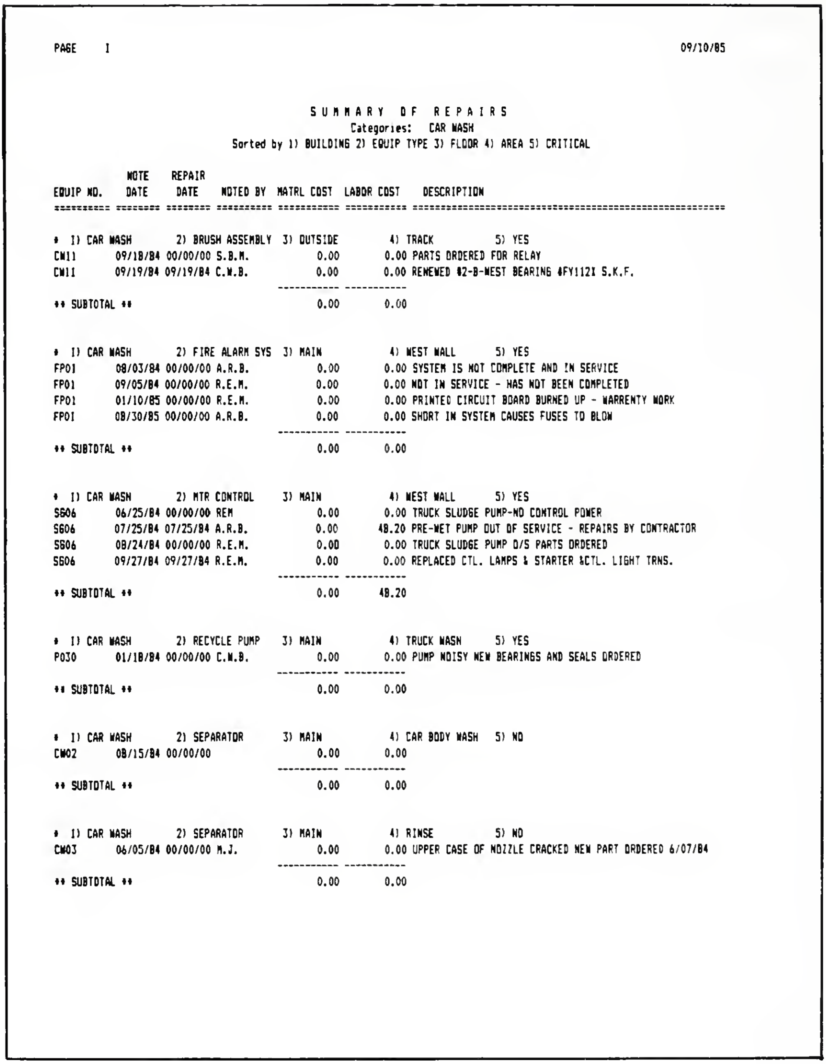
SPARE PARTS USED

SPECIAL NOTES

[illegible]	[illegible] DATE	[illegible] COST	EST. FIX COST	[illegible]

DESCRIPTION OF REPAIRS

ORIGINAL



```
PAGE    1                                                                                      09/10/85


                                        S U M M A R Y   O F   R E P A I R S
                                                Categories:   CAR WASH
                                Sorted by 1) BUILDING 2) EQUIP TYPE 3) FLOOR 4) AREA 5) CRITICAL

            NOTE     REPAIR
EQUIP NO.   DATE     DATE     NOTED BY  MATRL COST  LABOR COST    DESCRIPTION
========== ======== ======== ========== =========== =========== ========================================================

*  1) CAR WASH        2) BRUSH ASSEMBLY  3) OUTSIDE         4) TRACK           5) YES
CW11       09/18/84 00/00/00 S.B.M.            0.00        0.00 PARTS ORDERED FOR RELAY
CW11       09/19/84 09/19/84 C.W.B.            0.00        0.00 RENEWED #2-B-WEST BEARING #FY1121 S.K.F.
                                        ----------- -----------
** SUBTOTAL **                                 0.00        0.00


*  1) CAR WASH        2) FIRE ALARM SYS  3) MAIN            4) WEST WALL       5) YES
FP01       08/03/84 00/00/00 A.R.B.            0.00        0.00 SYSTEM IS NOT COMPLETE AND IN SERVICE
FP01       09/05/84 00/00/00 R.E.M.            0.00        0.00 NOT IN SERVICE - HAS NOT BEEN COMPLETED
FP01       01/10/85 00/00/00 R.E.M.            0.00        0.00 PRINTED CIRCUIT BOARD BURNED UP - WARRENTY WORK
FP01       08/30/85 00/00/00 A.R.B.            0.00        0.00 SHORT IN SYSTEM CAUSES FUSES TO BLOW
                                        ----------- -----------
** SUBTOTAL **                                 0.00        0.00


*  1) CAR WASH        2) MTR CONTROL     3) MAIN            4) WEST WALL       5) YES
S606       06/25/84 00/00/00 REM               0.00        0.00 TRUCK SLUDGE PUMP-NO CONTROL POWER
S606       07/25/84 07/25/84 A.R.B.            0.00       48.20 PRE-WET PUMP OUT OF SERVICE - REPAIRS BY CONTRACTOR
S606       08/24/84 00/00/00 R.E.M.            0.00        0.00 TRUCK SLUDGE PUMP O/S PARTS ORDERED
S606       09/27/84 09/27/84 R.E.M.            0.00        0.00 REPLACED CTL. LAMPS & STARTER &CTL. LIGHT TRNS.
                                        ----------- -----------
** SUBTOTAL **                                 0.00       48.20


*  1) CAR WASH        2) RECYCLE PUMP    3) MAIN            4) TRUCK WASH      5) YES
P030       01/18/84 00/00/00 C.W.B.            0.00        0.00 PUMP NOISY NEW BEARINGS AND SEALS ORDERED
                                        ----------- -----------
** SUBTOTAL **                                 0.00        0.00


*  1) CAR WASH        2) SEPARATOR       3) MAIN            4) CAR BODY WASH   5) NO
CW02       08/15/84 00/00/00                   0.00        0.00
                                        ----------- -----------
** SUBTOTAL **                                 0.00        0.00


*  1) CAR WASH        2) SEPARATOR       3) MAIN            4) RINSE           5) NO
CW03       06/05/84 00/00/00 M.J.              0.00        0.00 UPPER CASE OF NOZZLE CRACKED NEW PART ORDERED 6/07/84
                                        ----------- -----------
** SUBTOTAL **                                 0.00        0.00
```

which came with the equipment should provide the type and frequency of maintenance.

For older equipment, past experience and generally accepted practices can be used. The equipment information, specific location of equipment, maintenance procedures, and frequency are entered on a coding form. Also included is the amount of time that each procedure should take. These coding forms are used to establish the data base in the computer. This information on the equipment appears in the master equipment list.

The heart of making this system work in the field is the work order. This is a computer generated form that lists the maintenance procedures to be performed during a particular work assignment period. It is our practice to generate work orders and schedule work on a weekly basis. Therefore, at the beginning of each week, the foreman or supervisor knows all of the routine maintenance that needs to be performed each week and can plan the work assignments. On the work order form is the equipment identifying number, the location of the equipment, and the specific procedures to be followed. In addition to the separate work orders that are issued for each piece of equipment and for each craft that will be performing the work, the supervisor gets a scheduling report that summarizes the workload.

The work orders are distributed by the supervisor to the individuals who will actually perform the work. The work orders may be grouped by location or work, type of equipment, or craft performing the work to most efficiently accomplish the assignments. They are completed in the field when the work is done and then sent back to the office to be reviewed by the supervisor and updated in the computer. The employee may note on the work order form any additional work that needs to be performed which was beyond his capabilities or any parts which need to be ordered.

If the scheduling and procedures were set up properly the Work Order System will distribute the work load evenly.

The PM program should be capable of generating various reports that are essential to the management of the system. These reports are the key to productivity improvements.

The reports can be classified into two general categories: (1) Employee performance and productivity and (2) Equipment performance. The available reports indicate overdue work listed either by equipment or by work order. These reports are used to monitor completion of assignments. Productivity can also be measured by comparing the standard amount of time required for a procedure against the actual time recorded by the employee.

Equipment performance is measured by the summary of repairs report. All repairs, parts replaced, and costs associated with these repairs are listed. A repetitive problem with a particular unit may indicate improper repairs, improper equipment use, or equipment in need of replacing. By analyzing this report, problems may be predicted, thereby reducing the number of emergency calls and overtime.

Savings

Savings potential with a computer system are realized from the following:

Maintenance Labor — Ten percent increase in productive time due to automatic generation of work orders, improved work schedules, and reduced travel time. The amount of time to perform each task has been reduced because of employee familiarity with the procedures and parts required.

Equipment Failures — Reduced labor and material due to regular preventive maintenance and correct standardized procedures. Regular preventive maintenance also leads to increased equipment life.

There are also the intangible savings gained from the increase in time available for the employees to perform other tasks and the supervisor's ability to devote more time to special problems, planning, and on managing. Another intangible is the more professional attitude of the craft employees since they are not ''fighting fires'' all the time.

We have found the implementation of this system to be successful, as it has allowed us to significantly increase the number of units maintained without increasing the work force.

Mr. Kapp: Thanks, Ken. Are there any questions? I would like to know how long it took to set that program up and get all the bugs out of it?

Mr. Kulick: It didn't take long to get the program set up. The time consuming part of it was the accumulation of all the equipment data.

Mr. Kapp: Thank you. If there are no more questions we'll go on. Our next feature on the program is going to require the services of two speakers speaking on high strength concrete, the first of which will be Dr. Henry Russell. Dr. Russell is the director of structural development for the Department Construction Technology Laboratories, which is a division of the Portland Cement Association. Dr. Russell received his PhD from the University of Sheffield in England in 1956. He joined the Portland Cement Association in 1968 as a Structural Engineer. Presently he is Chairman of the American Concrete Institute's Committee on High Strength Concrete. Joining Dr. Russell will be Jim Cook, who is vice president of technical services for Gifford Hill Company here in Dallas. Mr. Cook joined Gifford Hill Company in 1968 as general manager and brings with him 26 years of experience in ready-mixed concrete. Mr. Cook is a member of the American Concrete Institute and the American Society of Testing Materials. Dr. Russell.

High Strength Concrete

by **Dr. Henry Russell**

Construction Technology Laboratories

and **J.E. Cook**

Gifford Hill Company

Dr. Russell: Thank you, John. In the first part of this presentation I'm going to be talking about the background history of high strength concrete and why it's been selected for the use in a number of very significant applications, and then Jim is going to relay to you some of his experiences from the end of the producer and the supply of high strength concrete.

Historical Background

The development of high strength concrete has not occurred overnight. It has, in fact, been a gradual development that has occurred over many years. At one time high strength concrete had a strength of 3,000 psi. In the 1950's 5,000 psi high strength concrete; in 1960, we got to 6,7500 psi; and in the 1970's we started looking at 9,000 psi in the commercial application. Currently strengths in the order of 11,000 to 14,000 psi are being considered for commerical applications. The usage of high strength concrete has gone along with a number of developments. One of these has been increased height of our tall buildings, and the other has been the need for longer span bridges.

I would like to go back a few years and look at some of these developments and give you some of the reasons why high strength concrete was selected. This is Lake Point Tower. For those of you familiar with Chicago it is situated right on the lakefront. It was built back in 1968, at a height of 645 feet. At that time this was the tallest concrete building in the world. The lower columns of the building contain concrete with the strength of 2500 psi. This was the first time that a concrete of this strength had been used in a cast in place building.

In 1970 One Shell Plaza was constructed in Houston, Texas. The height of this building was 714 feet which exceeds Lake Point Towers by 69 feet. The building was different in this case as light weight aggregate concrete was used. The project was originally conceived as a 35 story building. This was done because limitations on the foundations of the building. However, from an investment standpoint a taller building of 50 stories was desirable. A preliminary analysis showed that if high strength light weight concrete could be used, a 52-story building could be built at the original estimated unit cost of the 35- story building. The designer therefore called for a concrete with the strength of 6,000 psi, with a density of 115 pounds per cubic foot compared with a density of about 145 to 150 pounds per cubic foot for normal weight concrete. Extensive valuation of the materials in the Houston area was undertaken before the building was constructed. This required looking at available materials and determing the types of properties that these materials exhibited, and it enabled this 52-story to be constructed.

In 1973 Water Tower Place was started in Chicago. This building finished with a record height of 859 feet. This building is still the world's tallest concrete building. It is situated in Chicago right on Michigan Avenue. The base of the building occupies a full city block. The high strength concrete in this building was 9,000 psi. This was used in all the lower columns of the building. In fact, the building contains a total of 160,000 cubic yards of concrete, not all of that being high strength. This building was originally conceived as both a reinforced concrete building and a structural steel frame building. Without the availability of high strength of concrete, Water Tower Place would have been built as a structural steel frame building and not a concrete structure.

This is River Plaza in Chicago. It is another building of significant height, but it is one in which the owner and the designer were willing to allow two columns to be cast containing 11,000 psi concrete. These were experimental columns. They weren't required from the structural design standpoint, but they were cast to look into the problem of producing and placing

11,000 psi concrete. In addition to the two columns in the building, two dummy columns were cast, and these were used so that the concrete cores could be taken at later ages and measured how the compressive strength of the concrete developed over a period of time. Strengths were in excess of 11,000 psi.

This building is the Mercantile Exchange in Chicago. The columns for this building were originally designed for 11,000 psi concrete and this was done because of the previous work on River Plaza. However, when the owner found out only one concrete supply in the area could provide the 11,000 psi concrete, he decided to go back to 9,000 psi and get comparative bids that way. However, Material Supply was not undaunted by this. They got the 9,000 psi concrete job anyway, but they said "Let's try and go further. And this time we'll go for 14,000 psi." The columns were cast. This slide shows some data on the strengths of the concrete used in those columns. You can see we've got strength on the vertical axis and age on the horizontal axis. Strengths measured at 90 days ranged between 14,000 and 15,000 psi measured, at 180 days or rather 6 months ranged between 15,000 and 17,000 psi. It helps to point out that these concretes had a measured slump of nine inches. These were a very flowable and very workable concrete. Strengths at one year ranged between 19,000 to 20,000 psi strength range.

This is the Inter-First Plaza of the Dallas Main Center as it looks under construction. The building is now complete. The concrete design strength was 10,000 psi for the columns of this building. One of the reasons that high strength concrete here was specified was to provide a stiffer building for the whole height of the structure. It's a very slender building. Consequently, it's very susceptible to motions from wind. The designer therefore wanted to have a structure that was stiff. He estimated that high strength concrete could provide six times as much stiffness per dollar compared to a structural steel stiffened building. This building is at 921 feet which is the tallest building in Dallas.

Economic Factors

With high strength concrete in a column, the question of economy comes in. What is the cheapest way that we can transfer a given load from the certain height of a building into the foundation. This is some data published by a ready-mix supplier showing the costs of concrete in dollars per cubic yard versus compressive strength. These dollars per cubic yard are in-place costs. As you can see, when you move to the highest strength concretes, so the costs per cubic yard increases. But to carry the same load at a higher strength concrete you would in fact, need less cubic yards. Therefore, you are going to get a reduction, because you are actually using less concrete. How then, does this affect the overall cost of a column? This slide shows the total costs for a foot of height of a column to carry a load of 1,000 kips. As a function of the strength of the concrete on the horizontal axis, it would also be as affected by the amount of reinforcing steel. The load in the column can be carried two ways. One, through the concrete, partly through reinforcing steel. Normal codes specify a minimum of one percent steel and a maximum of eight percent steel. And these are the variations that the engineer can look at in terms of the cheapest way to carry the load. As you can see, the least cost is obtained with the highest strength concrete and with the least amount of steel reinforcement. In fact, reinforcement is a relatively expensive way of carrying vertical load columns.

Engineering Advantages

There are also some other engineering advantages apart from the economics that have come along with high strength concrete. High strength concretes have a higher margin of elasticity. They are stiffer. Therefore, you are going to get less shortening in your building if it's a vertical member you are looking at, and also you are going to get a stiffer building as far as lateral movements concerned. This is particularly true with design of the very tall buildings. The tensile strength of high strength concrete also increases as the compressive strength goes up. So even though you are getting a high compressive strength, you are also getting a high tensile strength. Now this is not very beneficial in columns, but if we look at pre-stressed concrete bridge girders, for example, the tensile strength of the concrete in some cases can control the design of those members. Utilization of the high strength materials can result in economies in pre-stressed concrete.

High strength concrete also has less creep than lower strength concrete. For example, a

9,000 psi cylinder loaded to a certain stress level is going to have about one-half the amount of creep that a 4,000 psi concrete would have loaded to the same level. This means that you get less vertical shortening in your high rise buildings; you're going to get less longitudinal shortening in your concrete beams.

So far I've talked about columns. Without doubt this has been the largest application to the present time of high strength concrete. However, there are other indications that high strength concrete is being used more and more in bridge structures. Three examples will illustrate this point.

This is a precast pre-stressed concrete bridge girder, five feet deep, with a main span of 161 feet, which was made utilizing 9,000 psi concrete. High strength concrete was selected to reduce the girder depth, obtain a higher overall strength and also, since it was a highway bridge, to reduce the wear resistance. The 161 feet could be virtually impossible to build as a bridge of this span with say 4,000 or 5,000 psi concrete. We can go to longer spans in bridges with the higher strength concretes.

Another type of structure where we are seeing a growth in the use of higher strength concretes is in long span box girder bridges. This type of structure is currently used for spans from 100 feet up to about 600 or 700 feet. As a result of the long spans the weight of the structures becomes quite a large portion of the load that the structure has to carry. Consequently, if the self weight can be reduced then the design can be more economical. The particular bridge shown here is a highway bridge in Nova Scotia, Canada. It was orginally designed and built with 5,000 psi concrete and a span of 700 feet. With 5,000 psi concrete the bottom slab of this box is 66 inches thick. If in fact the bridge had been designed with 8,000 psi concrete that 66 inches could have been reduced to 20 inches. Now this makes a significant reduction in the weight of the superstructure of the bridge, and consequently economy is the result of the savings in weight. It now means the superstructure weight is reduced, and also the weight that has to be carried by the foundation is reduced, and that's a second benefit.

Another application of highway bridges where weight is needed to be reduced is in cable structures which we are seeing more and more of now in the United States. For example the East Huntington Bridge across the Ohio River which goes between West Virginia and Ohio specified 8,000 psi concrete for the superstructure. Utilization of high strength concrete enables the weight of the structure to be reduced. Reported information indicates that strengths in excess of 10,000 psi are actually being obtained in the field on this structure.

Summary

In conclusion of my portion, let me summarize then the advantages of high strength concrete and why design engineers will continue to specify these higher strength materials.

First of all it provides the highest strength per unit cost. This is very beneficial in the application of columns. Not only for high rise buildings but we're also seeing greater applications in medium rise buildings. The objective here is to reduce the column size as much as possible, thereby increasing available rental floor space; you opt for more flexibility in the layout of the internal portions of your building. High strength concrete can also provide the highest strength per unit weight, and this is important when we are looking at the bridge structures, where one can keep the weight down as much as possible.

And finally, we've seen that high strength concrete can provide a higher stiffness per unit cost compared with other structural systems.

I'm now going to hand over to Jim Cook who is going to talk about the application and production of high strength concrete.

Mr. Cook: Good morning, ladies and gentlemen. Welcome to Dallas.

I thought that in these few minutes I had I would just share with you our experience in the development and use of high strength concrete in Texas.

Our first experience not really considered real high strength concrete, was the Texas Commerce Tower project in Houston. This was a composite design, about a two million square foot structure. The height of this building is about 1,000 feet. This project required about 94,000 cubic yards of concrete and about 35 to 40 percent of that was to 6,000 psi or higher. So this was our first really big exposure to high strength concrete. What we've learned when we were approached by the structural engineers to develop this high strength concrete, was that we had to go to our laboratories and conduct a real extensive study. What we have learned at this point and this was back in 1979, you know with straight poured cement there is a limitation to what you can do. You get the forms to about eight or nine sacks of cement. If you add additional cement you will not increase strength. You reach a point of diminished return. This illustrates what with the addition of these additives we can do with these products. Here you see just a stress-strain curve of a straight eight sacks of Portland cement concrete mixture. You see it peaks there at a little over 8,000 psi in 28 days. But through that mixture we can add a chemical admixture, a water reducing admixture, so we increase the strength 1,000 psi. Then to that we add 25 percent of the weight of cement, when added 188 pounds of fly ash to that same mixture we increased the strength to 2,200 psi. At this time we were not investigating high range water reducers, but to that same curve I could add a high range water reducer commonly known as superplasticizer and increase the strength another 2,200 psi. What we are doing here is to increase cement efficiency by 41 percent at about one-ninth the cost of the cement. So this is a key in producing high strength concrete. This shows you some of the trial batches we've set up after we conducted a really extensive study. To determine our mix proportion we have to establish a content-strength curve, and we select our proportion. This project had a specified strength of 7,500 psi in 28 days. Our target laboratory strength was 9,700 psi in 28 days. We also were testing specimens of a later age. These concretes with fly ash incorporated into the mixtures increased strengths over time. The strength at six months test stage were over 12,000 psi. This just shows you strength curves that we use. here we used 640 pounds of cement and 160 pounds of fly ash. This shows the valuation of test data at the completion of the job. ACI building code gives a statistical specification with regard to acceptance criteria. That concrete mixture averaged 8,146 psi in 28 days, but it averaged over 9,000 in 56 days test stage. I think we had about five out of about 139 tests that had strengths less than 7,500 psi which was well above that required by the code.

Henry talked about this project, so anyone who has been downtown has probably seen this. This is this Inter First Plaza, Phase I of what the developers call Dallas Main Center, which is about a billion dollar development. The second phase includes another twin tower similar to this. The first phase included this structure plus a 16-story parking garage. The building that Henry mentioned is 921 feet tall. It's one of the 12 tallest buildings in the world, but it's the slenderest of all the buildings of the top 12 buildings in the world. It has a height to base width ratio of 7.2 to 1, compared with the Texas Commerce Towers that has a height to base width ratio of about 6.4 to 1. So the primary concern of the structural engineer on this project was the stiffness of the concrete. They wanted a high proportion of elasticity.

All the vertical gravity loads and all the wind loads are carried on 16 columns. The column sizes vary from eight by eight to the smallest which is six by six. Another unique feature about this structure is the fact that floor slabs extend 20 feet beyond the column line. All the outside offices have unobstructed views. You don't have a column you have to look around. This project used, 84,000 cubic yards of concrete. We required about 20,560 cubic yards of 10,000 psi concrete. Column footings utilized 8,000 psi high strength concrete.

We topped it out on July 3, 1984, and on July 4th we had the flag hanging on the side.

When the structural engineer came to us and the developer came to us back in June, 1981, and asked if we could produce 10,000 psi concrete I told them I thought we could, but we would need some time to investigate it in our laboratories. So during a period of about 14 months we put out 100 laboratory trial batches that we plant batched and field tested about 92 yards of concrete before we ever started construction of this project. We even cast a little column so we could evaluate core strength versus column strength so that if we did have problems on the job we would know what the correlation was. This shows you a lot of tests. We even made beams and ran flexural tests. Henry referred to tensile strength. We got flexural strength in excess of 1,300 psi with this same concrete. It's about 13 times the square root of f prime c. In this job, the column size varied. The largest column was eight by eight, so we not only had high strength concrete, we had mass concrete. The engineers were concerned about the temperature rise of the concrete because of the high plastercize content so we cast some six by six foot blocks, moderate temperature rise. The concrete temperature in some of these columns reached about 200 degrees farenheit after about 15 hours.

Almost all the published literature on high strength concrete will tell you that minimum size aggregates will produce the highest compressive strength. So our investigations confirmed those same results. The smaller your maximum size aggregate the higher the ultimate strength you can produce. For a given water-cement ratio we get higher ultimate strength with the 3/8 inch maximum size aggregate. At that point there is no penalty for using the small aggregate. That was without a plastercizer. But with a superplastercizer, we can produce even with the larger aggregate, the same as we can using a 3/8 inch maximum size aggregate. The high range water reducer has allowed us to do a lot more than we used to.

This shows you the water cement ratio and the compressive strength on the y axis. Without a high range water reducer the maximum strength we can produce with a one-inch size aggregate is about 9,500 psi. But when we add a high range water reducer we are getting an increase of over 3,000 psi in the strength just from the use of the high range water reducer. We are getting a better bond between our aggregate interface and cement matrix. We did learn in this study that the largest size aggregate will produce the highest internal elasticity. This is why we try to produce higher strength concretes with larger aggregates. Most of all the high strength concrete used today incorporated very small aggregates. There again it shows with a small aggregate you don't get as much strength enhancement but you get higher strength.

We found that these high range water reducers can be used to retemper the concrete. We had a problem with a concrete truck that had broken down, and the concrete set on the job for nearly an hour, and you see on the right, there's a right column, that concrete is about an hour old. All we did was just add more high range water reducer, and you can see the effect on strength. All it did was to increase the strength at all ages. We were getting 28-days strengths in seven days. That's why it is 11,000 psi in seven days for that concrete.

This is a stress-strain curve with high strength concrete. This is seven days age. Maximum strength there is 9,400 psi, and if you compare this with normal or lower strength concrete, you'll find that this stress-strain curve has a higher slope and the strain at maximum stress is less than that for normal concrete. The strain here at maximum stress is about 0.00023 inches per inch. But that results in a bunch of brittle failure. That concrete had a compressive strength of over 14,000 psi. One of the biggest problems that we've found in high strength concrete is not so much producing it as testing it. That's a big problem. You have to be very careful. It's more critical than with normal strength concrete. This is just some of the problems you can have. You see this concrete was not uniformly loaded. We didn't get the failure at the mid-height of the specimen; it was just loaded to one side. So that test cylinder had a compressive strength of about 2,500 psi less than its companion. You can see it is not uniformly loaded because of a bad cap.

This is a graph showing the actual strength tested for the Inter First Plaza. We do have good agreement with normal distribution and a lot of earlier reported data indicated that with high strength concrete you are going to get a more skewed distribution. But you can't get much better than that. We have a stress range from 10,000 psi to a high of about 14,000 psi. This is concrete tested at 56 days. Average strength is 12,103 psi in fifty-six days. That concrete averaged about 7,500 in about three days, about 9,500 in seven days.

This will be a good place to stop. My time is up. Thank you.

President Staplin: Thank you, Dr. Russell and Mr. Cook. Are there any questions for their presentation?

That was certainly a most informative presentation.

I would like to call on Ken Welch at this time, our program chairman for our last special feature of the morning. And at this time the people on the dias can step down since this is a panel discussion.

CROSS TIE DISPOSAL

Panel Discussion

Mr. Welch: It is with pleasure that I introduce this distinguished panel of Roadmasters' members to discuss the topic of Cross Tie Disposal. The topic is near to all of our hearts. First, on my far right, is A.J. Dolby, from Dolby Associates. A.J. has had much experience with the AAR studying the problem. Then we have Marv Nelson, regional engineer of the BN. Luther Denton, chief engineer of line maintenance with the Southern. Paul Armstrong, engineer of track with the Union Pacific. We originally had Don York with C&NW, but Don was called away last night.

First of all, I would like to have Paul Armstrong of the UP address the issue of cross tie removal from a cut tie standpoint. I would like Paul to address the issue of why the UP has chosen to remove ties by cutting, and disposal methods for cut ties. Please address the advantages and disadvantages of this method. Paul.

Mr. Armstrong: The goal of the Maintenance of Way Department on the Union Pacific is to maintain a safe railroad that trains can be operated over, maintaining on-time schedules and on-time deliveries at the lowest cost. The cross ties play a very big and important part in being able to maintain a good safe track structure.

The Union Pacific, including the former Western Pacific, is currently maintaining approximately 42 million cross ties with an average tie life of 37 to 40 years. Various types and sizes of ties have been used, but predominantly the ties in the main lines are wood ties, 7 inches by 9 inches by 9 feet long. Eight foot ties are used in secondary main track, yard tracks, and industry tracks.

The territories that are selected for tie replacement are usually recommended by the district roadmaster, then a system tie inspector marks the ties that are to be replaced. If the tie condition warrants, the territory is then placed in the tie renewal program for the following year.

Several methods are used to replace defective ties. Many ties are removed in one piece in conjunction with sledding and plowing programs. Ties are also removed in one piece in conjunction with high lift surfacing programs, but most of the ties are removed by cutting the ties into three pieces with dual tie saws.

Territories selected for tie renewal by the cutting method, for the most part, are main lines where maximum authorized speed for freight trains is 70 miles per hour. The ties to be replaced usually average between 400 and 600 per mile. Slow orders are placed where tie gangs are replacing ties and are maintained a sufficient length of time behind the tie gangs to ensure track stability.

In order to keep slow orders to a minimum, the cutting method is used to remove the old ties, as this method is a fairly quick, efficient way of removing old ties without greatly disturbing the surface and line or stability of the track as compared to some of the other methods. Also, another advantage of cutting the ties is that it permits removal of the old ties in some confined areas such as adjacent to platforms, through tunnels, and on ballast deck bridges, where there isn't enough room to permit removing the old ties in one piece.

The major disadvantage of removing the old tie by the cutting method is disposing of the old ties. In comparing the disposal of the cut ties as opposed to the whole ties, in many areas there isn't really that much difference in the disposal problem. In remote areas that lack good roads and the lack of demand, the problem of disposing of scrap ties is about the same.

To sum up the main advantages and disadvantages: the main advantage is the old tie can be removed economically without much disturbance of the adjacent ties. Therefore, the surface, line, and stability of the track structure are not affected to the extent it would be if the ties are removed by a method requiring raising of the track. This also permits a tie gang to work with rail temperatures at a higher temperature as opposed to a method that requires raising the track, due to maintaining better track stability.

Speed for trains may be increased and slow orders removed behind the tie gangs sooner, causing less train delay again, because better track stability can be maintained.

The main disadvantage is the disposal of the old ties, as there isn't the demand for cut ties that there is for whole ties.

Thank you.

Mr. Welch: You've all heard it now. You take the ties out in pieces to minimize track disturbance and slow orders. I'd like to go now to Mr. Denton. He's from the Southern. They take their ties out whole and have for a long time. So we'll let Luther give his side of the story.

Mr. Denton: Thirty years ago we developed the first tie removal machine used on our system. This machine was designed with a ram chain to push out the old tie and pull in the new tie. The tie replacing machine went through many modifications through the years, but we still have a few in service using this basic concept.

There are currently a number of machines on the market designed to remove the old tie and install the new tie. You've seen some of them on display here at the yard in Dallas. These machines are improved each year for increased productivity and minimum disturbance of track line and surface. Generally speaking however, it is necessary to surface track in conjunction with whole tie renewal. We like this concept, and our gangs are equipped to timber and surface the track in one operation. This disturbs tracks for the least period of time and can be carried out on the one slow order with minimum delays to traffic. A timbering and surfacing gang moves in and completes a segment of track in one operation. We do have a few small gangs that do work basically in yard and industrial areas that cut ties in three pieces. However, we plan to phase out this in the near future. All of our mainline gangs are equipped to remove whole ties and to bundle the released ties and surface track in the same operation.

Some of the advantages of whole tie removal are:

The old tie bed or hardpan is not disturbed. This is particularly beneficial in track segments through limestone areas and in track that tends to become foul and muddy. We have a good number of miles of railroad up through Kentucky and Tennessee that are built on a limestone shelf, and we have experienced through the years that to destroy that old hardpan increases muddy track and sloppy track. We believe that by taking out the old tie and putting in the new tie without having to scarify that bed we get a better job. Instead of disturbing the roadbed by scarifying, the track can be raised above the foul material for improved stability and drainage. The handling and disposal of old ties is easier. The old ties can be bundled in the gang operation and picked up and loaded in gondolas immediately behind the work. Many times the same work train unloading ties ahead of the gang can be used to pick up the bundled, released ties behind the gang.

There is good utilization of ties removed. On some territories with heavy tonnage and numerous curves and grades many ties become spike killed from gauging and rail renewals. Many of the ties that will not hold gauge at these locations because of the conditions described can be turned over and used on light tonnage branch lines or in yards. The ties can be segregated and bundled separately as they are removed from the track. These bundles can be tagged and picked up for distribution on a branch line. We have a number of such lines on our system where tonnage is less than 1,000,000 gross tons annually, and the use of relaid ties mixed with a sufficient number of new ties will provide a sound maintenance program for these lines. In many areas ties not suitable for reuse can be stalked at team tracks or other locations and sold to contractors for landscaping. Others can be given to local property owners or charitable organizations. This is good public relations. In any event, whole ties regardless of their condition, are easier to handle and dispose of than tie butts. Right-of-way is not left cluttered with tie butts and tie pieces. We leave a better image to the public when we keep our right-of-way cleaned up. Tie butts left along our right-of-way are an open invitation to vandals to place them in the track. Vandalism is a big problem in many areas. I feel that our policy of removing whole ties, timbering and surfacing in one operation, cleaning the released bundled ties immediately behind the work and the utilization of suitable relaid ties is a good maintenance policy. Thank you.

Mr. Welch: The Southern also removes ties with track quality and minimum track disturbance in mind. We have a disagreement. Both UP and Southern have the same reason for doing the job differently. We will return to these gentlemen a little later but let us first hear from Marv Nelson about some specific tie disposal problems on the Burlington Northern and see how they are dealing with it.

Mr. Nelson: Within the State of Wisconsin, Burlington Northern has 222 route miles of track. Two hundred fifteen of these miles are double track and all of this trackage lies either right on the Mississippi River or immediately adjacent to it. From the period 1975 through 1983, 1,170,000 cross ties were removed by the three piece removal method. During this time, the State of Wisconsin Department of Natural Resources would not allow us to dispose of any of these ties by chipping, burning, or burial. They were approached on various methods to do this. Of course, burning violates the State and Federal EPA Commission laws. Chipping of any of these ties on this right-of-way is out. Whenever high water would come up from the Mississippi River all the woodchips would get into the river so that was an unacceptable method. Burial of the ties has been discussed with them at time. All of the right-of-way in Wisconsin being along the Mississippi River was within the flood plain, and of course to get a permit to bury in a flood plain is almost impossible. To get to a burial site off the right-of-way would cost a lot of money to transport the ties to it and also governmental requirements are very extensive to develop a burial permit.

In November 1983 a hi-rail trip was taken to get a detailed analysis of the problem that really existed on the ground. During this trip it was developed that about 15 percent of the ties that had been removed from track had now been removed from the right-of-way by local citizens through the smaller towns on this track and adjacent to the highway crossing. This left us with about 1,000,000 ties or 3,000,000 pieces of tie butts that had to be disposed of. As I mentioned earlier, of those ties that had been removed by local citizens some also were burned on the right-of-way by people along this area. It's very popular fishing spot and in the wintertime people come out, take these ties out to river, and burn them for heat or use them for sitting on while fishing or whatever. Of course this becomes a complaint to us also.

During this eight year period we also were cited for 38 violations for burning of cross ties by the Wisconsin Department of Natural Resources. They have pictures and other documentation showing the facts. Each one of these violations could be subject for fines ranging from $10 to $25,000 a violation.

In 1984 the Department of Natural Resources turned this matter over to the State's Attorney's Office who put us under a court order to enjoin us from burning ties again and also to develop a plan to pick up and dispose of the existing ties. One of the reasons this action occurred at the time was that the Northern States Power Plant at LaCrosse, Wisconsin, finally got a permit to dispose of ties by burning which would meet the State's requirements. This was the first time that we could physically have a legal manner in which to dispose of the ties, so now they come down and are forcing us to take action. Also, if we were to have high water, these tie butts would be picked up and washed into the river. We could be fined for that, plus we would have to pay for the cost of the removal of the ties from the River.

It now becomes very important with all these matters coming to a head to develop a plan to remove the ties in as cost effective a way as possible. Of the 1,000,000 ties that we estimated were remaining on the ground, approximately 700,000 of these ties were stacked on the shoulder adjacent to the track section. The remaining 300,000 ties had been knocked over the side of the slope on the embankment and were scattered along this way.

Typically, the embankment along this area is from 10 to 14 feet high, heavily riprapped with about a one to one or steeper slope. This makes it very difficult to retrieve ties from this area. Approximately 33 percent of the embankment on both sides to the track has conditions similar to this.

Here's another example of some of these locations. In this area you can see there is a heavy growth of trees. A lot of the tie butts are down into the trees, and this will be another problem getting these tie butts up so they can be retrieved. Also along the other side of the track and next to the hi-rail you can see a coal mine that is right adjacent to the track with many of the tie butts strewn underneath.

Here's another problem area on this track. You have the river on one side and on the other side you have a lot of this bluff area protected by a slide fence. A lot of the tie butts end up behind this fence, making it very difficult to retrieve the ties.

The problem of course in a project like this is twofold; with the volume of ties you have to hold down the removal costs, and secondly, the track time. As you can readily see it will not be possible to pick any of these tie butts up from normal highway vehicles. It will have to be done by track vehicles so we have to have a work train to get ties up and disposed of.

In November, 1983, a time study was done on experimental pickup of ties by using a work crane with tackle. The study went on for six days, at which time we were able to retrieve an average of 1,450 ties per day. The cost of this removal was $1.90 a tie and that only includes the cost for picking up on the shoulder area and getting the tie into the car. Of this $1.90, $1.04 was associated with the work train cost which is strictly unproductive cost for this operation. Also this operation would have taken track time for 700 days and interfered with our traffic, which was also unacceptable.

We are working with a manufacturer to develop a new machine to pick up ties for this particular application. Here is a scale model of the machine which is now in production and is scheduled to be delivered in November 1985.

This is a little better deal. What this crane is set up to accomplish is to have a small crane down front. Part of the purpose of the small crane being down low is to reach out further from the track, and also to be able to reach out underneath the pole lines. The crane will pick up the ties and neatly direct them up to the car top conveyer. Another purpose of this crane being low is that the amount of mobility between where it picks up the tie and where it places the tie. It continues moving down. It is very short, and this allows for a lot more picking up of the ties than with the tie handler. The ties will go across to the upper conveyor, and they will be knocked off the conveyor. There will be three cars behind this operation that hold the ties. The conveyor will load from one car to the next. The purpose of this is so once you get out on track time, you will not have to stop and run to the siding because you have the car for ties.

With this problem, we have been using wood chip which we have available. They have 11 feet high sides and are 60 feet long. We estimate that we can get up to 1,000 ties in one of these cars. For the operations machine here, you are looking at one man to operate the crane to pick it up and one man to operate the motivational crane. He will sit on the higher place in the middle there and he will also control the knocking of ties off the traveling conveyors. There will also be one foreman, so this project, which can pick up 3,000 ties a day, is really not too labor intensive.

With these speeds and the fact that no work train is required, we're looking at a cost of picking up the ties from the shoulder and getting them into the car of about 25 to 30 cents versus $1.90. We needed this type of economy to be able to make this project work. All of these costs are only for picking ties up from shoulder and getting them into the car. As you saw earlier many of the ties were scattered down over the sides of the embankment, and in our earlier study we estimated it would cost from one to six dollars a tie to retrieve these ties up to the shoulder so that this machine can pick them up. Even with this machine it is going to be very difficult and costly to do the project. Of course, once we get these ties loaded into the car we have the problem of disposing of them.

At this present time, we are going to be shipping these ties to Brainerd, Minnesota, and selling them under a contract to a power plant company for generating steam. Prior to developing this solution we had worked with the power plant in LaCrosse, Wisconsin, to burn ties. They, of course, knew that we were in a position of having to dispose of the ties, so they were not very willing to pay a high price for the ties. The price that they would give us for burning the material would be about 25 percent of the value of the material. Also, we would have had to shred all the material and truck it over to the power plant. This would be double handling and expensive. The power plant had a limited capacity, which meant that we could only shred 700 ties a day. To pick up 3,000 ties, we would have to do a lot of double handling and stockpiling. When we evaluated the entire project we found that it became cost effective to ship the ties to Brainerd, Minnesota, an average distance of 400 miles farther than LaCrosse which is located right in the middle of these 200 miles of track.

Mr. Welch: Thank you, Marv. A very big problem that won't go away. This gives us a feel for the economics of loading the ties and then transporting them for disposal.

Now let's hear from Mr. Dolby who will address the environmental aspects with some possible direction as to where we may want to be heading.

Mr. Dolby: The historic disposal methods for discarded cross ties are burning, burying, shredding, or leaving them on the right-of-way. These methods are no longer viable disposal techniques in most states. In all but the most rural areas, pollution control regulations now prohibit the use of these disposal methods except for landfills. Landfills have not been prohibited, but the regulations governing their operation and the potential long term liability associated with them makes their operation only feasible for a professional landfill operator. As a result of these changes it is now necessary to remove most ties from the right-of-way.

Since ties must be removed from the right-of-way at considerable cost, it would be highly desirable to sell or re-use the ties at a price that would cover these costs and generate a reasonable rate of return. One method of disposal which can accomplish this is incineration. The types of incineration available are:

1. Whole tie incineration in small incinerators.
2. Fluidized bed incineration for space heating at temperatures in the 1,900 to 2,000 F. range with the flue gas being piped through a boiler for steam production. The steam can then be used for space heating and process steam generation and for powering steam turbines for electricity generation.
3. Fluidized bed gasification at temperatures in the range of 1,450 to 1,500 F. where the cross ties are converted to a low BTU gas. The gas can then be burned in an existing gas burning boiler to produce steam or it can be burned in a motor generator set to produce electricity. The electricity or steam can be used by the railroad or sold to an industry.
4. Some power plants have installed the necessary equipment and obtained the necessary permits to burn discarded cross ties. These plants will pay a minimal amount for the ties as a fuel if they get a guaranteed supply.

Mr. Welch: Now we'll go back to Paul. I haven't heard anybody talk about chipping and I know we talked about burning in a power plant but environmentally what are the implications of chipping and burning along the right of way? Paul, does the UP burn or chip?

Mr. Armstrong: We use all of these methods in some locations. What we can do in one location, we may not be able to do in another. We many have an area where we are able to chip and spread the chips along the right of way.

Mr. Welch: Luther, I'm going to ask the same question of you.

Mr. Denton: We do not burn ties on our system as a general rule. We have tried chipping ties, both whole ties and butts. We found that good chipping is an expensive proposition. The maintenance of our machines to chip up cross ties was quite high, so we no longer chip ties. We bundle all the ties that are removed in bundles of 16 each, and then we come back and pick those up with a work train, and we unload them on a team track or along a place that's accessible to the highway. We have some landscaping contractors in some areas who have contracts to get these ties. In some other areas, you always get a lot of demand for cross ties from local property owners, Boy Scouts, boy's clubs, churches, many, many organizations, and we do pick these ties up and make them available.

Mr. Welch: At this time I would like to ask if anyone from the audience has an answer or a question, preferably an answer, but I don't expect that you have the answer. I know you've all had a cross tie problem.

Jay, would you address for us the water pollution question. What about ties in the river? We have a lot of B&B guys out there, and they might see a tie floating down the river, and it might look like it came out of a bridge. In fact, a trackman wounldn't throw it in the river. (Laughter)

Mr. Dolby: Anytime used ties or other creosote treated materials come into contract with water, the potential exists for environmental damage from creosote residue leaching into the water. This is true for ties in streams, in drainage ditches, or buried where they might come into contact with groundwater. This problem has become much more acute because creosote has now been classified as a hazardous chemical.

It is interesting to note that the chemistry of the creosote in a used tie is considerably different from the chemistry of creosote in a new tie. The amount of creosote residue remaining in a used tie varies, depending on whether it came out of a yard or a high tonnage mainline, and the climate in which it was located, but the overall average is 3 lbs./ft.3. These 3 pounds are the residue that could not evaporate, be drawn out of the tie by the sun, or be washed out of the tie during the 35 years or so it was in track. In other words, it is the very thick, fairly non-flammable portions of the creosote.

Mr. Welch: I want to come back now for one question with Luther and Paul regarding the storage and the removal of ties. Historically, both the Southern and the UP took out their ties whole or cut for track-related reasons. We are out there to run trains, but I'm wondering now if the cost of removal, the cost of the fines if we don't remove it and so forth should be considered in determining the method of tie removal as well as the cost of fixing up the track after removal. Both members said that one of the advantages of their method of removal is that they are leaving the track in better condition. I want to talk a little bit about this, so that again, we can re-evaluate why we have chosen the methods we have for removal. It seems that both railroads have the same reasons for doing things differently and thus the decision should be an economic one.

Mr. Denton: As I pointed out, I see some advantages in tie removal for not disturbing that tie bed. If you scarify a tie bed you lose that hardpan and, in my opinion, it takes some time to get that back. You take up the tie and put the new tie in and you give your track a surface all in the same operation. You do not destroy that old tie bed. There is some disturbance in track. I'd say the machines are being improved for minimum of disturbance of line and surface. You're right, you get some disturbance when you pull ties, but we like this concept of doing it all in one operation. Therefore, we don't have to come out and install ties, and then come back in a week, or a month, or so later and disturb some track. We do it all in one gang operation, on one slow order, with one set of supervision, and we do run slow orders. We cover that in our operating procedures. We have a procedure for maintaining track stability, and we specify what the slow order will be. We range from a 10 to 25 miles per hour slow order while the work is going on. Of course, the lower 10 miles per hour slow order is used during hot weather when track building is possible, and, in the cooler weather, depending upon the density of tie removal, we run a 25 mile per hour slow order. On welded rail we will work with a slow order between 10 and 25. On jointed rail we do not because of the rocking characteristic of certain cars on jointed track.

Mr. Welch: Are there any questions?

Member: What is the cost of the machine?

Mr. Nelson: The cost would be about 50 cents if we pro-rated it only over the 1,000,000 ties. We are looking at using it for other purposes.

Member: What is the relative cost?

Mr. Nelson: Just under $600,000.

Member: How long are the slow orders?

Mr. Armstrong: Basically, we operate the first train or first three trains at slow speed prior to the initial settlement of the track, and then we have a maximum speed of 25 miles an hour for a minimum of 24 hours, and, then if conditions warrant, raise it to 40 miles an hour for another 24 hours before we remove the slow order. When conditions so warrant we normally carry the slow orders over 36 hours.

Mr. Denton: We are working under a 10 mile an hour slow order during the day when conditions warrant and we will raise that order to a minimum of 25 a night. We will run the order for several days, maybe 24 or 36 hours, depending upon the type of density. We feel that if we require a certain amount of speed cutting to get the stability back, we base it on the tonnage over the track and the number of trains in a week.

Member: Who makes the determination on the slow orders? Your track foreman, or your division engineer, or the chief engineer?

Mr. Denton: The gang supervisor working through the foreman puts out the slow order. We have guidelines in our operating procedures that specify when a certain type of order will be used. For instance, if the rail temperature is 110 or will get up to 110, automatically we go to a 10 mile per hour slow order during the day while the work is going on.

Member: How long is the slow order?

Mr. Denton: That will vary according to the size of the gang. We have some gangs that will cover two miles a day. It depends upon the number of ties being removed and the size of the gang.

Basically, we will not cover more than three miles in a day. We have gangs that will put in over 2,000, 2,100 or 2,200 ties a day. Generally speaking, a maximum of about three miles is covered in that area. Of course, the work order would not necessarily cover that entire three miles in an eight hour workday period. For instance, if the gang is going to work, and you're going to be clearing some trains at midday, then you might have an order out for a mile and a half at ten miles an hour and another mile and a half at 25 miles an hour and at noon or 12:01, ten miles an hour over the other section. When going to work at eight o'clock in the morning he knows he's going to get three miles down the track, he shouldn't hold ten miles an hour over a portion of track that he will not possibly get to until sometime in the afternoon. But there again, the decision is that of the gang supervisor knowing these conditions and being governed by operating procedures that are set up.

Mr. Welch: Any other questions?

Member: Has the market for the landscaping ties been dwindling over the years?

Mr. Denton: In larger metropolitan areas I do not see a dwindling of that. For instance, in the Atlanta area there is a great demand for ties. However, we do not, as a policy, load ties and haul them for long distances ourselves. We pick up the ties and stack them in a general area, and then it is the responsibility of the contractor who has bid on those ties to take them from the areas.

Member: What if he loses his market?

Mr. Denton: If he loses his market there would be some glutting but as I say, with the other demands that we get, there are very few areas where we have a problem of getting rid of the ties. We have requests that come in on a regular basis, and what we will do is that when somebody requests ties we will respond to those people that we will be working in that area at a certain time, and we will get in touch with them when the ties are available. We do not like to load ties and ship them because it is an additional cost to them. But we, in picking up ties, can take a long drop-end gondola and, with a crane on a flat car between them, load the car beyond its capacity because we're only going to move them a short distance, unload them, and stack them. And that way you don't require switching during the day. You can take a work train and pick up a lot of ties during the day without switching every time you load two cars.

Member: Do you band the ties and pick them up with a crane?

Mr. Denton: The ties are bundled and banded as they are removed from the track. We use some type of tie handling machine to pick up the ties, load them onto a car and band them in sixteen ties to the bundle. These bundles are dumped along the side of track, and then we'll go back with a work train and pick up the bundles for disposition. But all ties are bundled in the operation of the gang itself.

Member: Do you band even the bad ties, the splinters? Or do you only band good ties?

Mr. Denton: We band anything that will stay together. Of course you'll get some pieces that will break up. Anything that will stay together as a whole tie, yes, we'll band it.

Member: Mr. Nelson, are you using an open top boxcar sixty feet long?

Mr. Nelson: We are using a wood chip car, it's about sixty feet long and eleven feet high.

Member: What kind of a method are you using to keep working all those butts back?

Mr. Nelson: There is a conveyor across the top of the car and it will have a type of arrangement that will be moved as you go along a section of the car.

Member: How do you get the tie butts out of the car?

Mr. Nelson: In this case we are sending them to the contractor and his costs will be complete removal, so we don't have to worry about that.

Member: Have you considered using an air dump car?

Mr. Nelson: Well, then it becomes an item of pricing in an air dumper versus the 11 foot high side car. Because we ship them 400 miles, we need high capacity cars.

Mr. Welch: As you can see, this is a many faceted problem. We had a lot of discussion before we got up here with this and what we've really come down to is that each situation is it's own situation. Anywhere you go you have alternatives, but one alternative that we don't have any more is to leave the tie out there. We just cannot do that.

It's an economic issue from the railroad's standpoint. If somebody can sell the London Bridge, well maybe we can sell all our ties to landscape it with, but that just isn't proving so. In some areas the market is dwindling. We have a lot of people who want the good ones but don't want the bad ones. So, wrapping it all up, I would say that you continue to think about it more. You can't let them lay out there. It's an economic issue. Each situation takes special handling. We need a lot of help from the equipment suppliers to deal with equipment problems. We need help from the regulatory bodies to help us with the pollution problems that may be encountered in burning, even if we do go to a power plant. There are a lot of areas that have to be dealt with, and it's going to get bigger.

Thank you.

President Staplin: Thank you, Ken. The Panel did a lot of work in preparing for their presentation and it certainly showed in the quality and in the response from the audience.

I'd like to take just a minute to recognize some people from the Roadmasters' Association who have worked especially hard at this conference and who have chaired the key committees in helping to make the conference operate. Probably the most difficult job of all at these affairs is that of the Program Chairman, and what I'm going to do is to ask these people to stand up, and then I would like to recognize them after they are all standing. The Program Chairman is Ken Welch from the Missouri Pacific Railroad. Chairmen of the Standing and Special Subjects also have an especially hard job and the two gentlemen this year did an admirable job. John Smith of the Union Pacific System and John Swiderski of the Canadian National. Also in helping with the ladies activities as a late fill-in, as a back up, for Mike McGinley, who had to leave on that SP derailment, is Hugh Fuller from the Chessie System, and also for the ladies is Byron Burns from the Santa Fe who was the B&B Ladies Chairman. Also carrying the registration committee is Jerry Cossel from Conrail; also our office staff, Pat Weissmann and her helper, Brenda Gilmore. I think we should also ask Frank Semans of REMSA to stand. We also appreciate, of course, the tremendous job that REMSA did in putting this together and also Vi and Jim Stallmann of REMSA. I think all these folks and the B&B folks deserve a good round of applause.

At this time I would like to call on Jerry Wood, Chairman of the Resolutions Committee. Jerry.

Report of the Resolutions Committee

Having reached the closing of the annual joint conference of the Roadmasters and Maintenance of Way Association of America and the American Railway Bridge and Building Association, and being deeply indebted to all those members and friends who have contributed their time and efforts to make our conference a success, it is right that we should acknowledge this indebtedness and that it shall be so entered into the minutes of this meeting.

Be it further resolved, that our deep appreciation be extended to those who have honored our associations with their presence by their informative addresses:

D.H. Hoffman, President, Elgin, Joliet and Eastern Railway Company,
A.C. Jones, Jr., Vice President Engineering, Seaboard System Railroad,
P.R. Richards, Chief Engineer, Canadian National Railway,
Joseph R. Beckman, Chessie System Railroad,
LeRoy Vague, Minnesota Department of Transportation,
Chiaki Seki, Japanese National Railway,
J.R. Williams, Alfred Benesch and Company,
J.T. Kapp, Conrail,
Steward Currie, British Rail,
V.P. Mahon, Bay Area Rapid Transit System,
K.L. Kulich, Amtrak,
J.E. Cook, Gifford Hill Company,
Henry Russell, Construction Tech Labs,
M.J. Nelson, Burlington Northern,
D.R. York, Chicago and North Western Transportation Company,
M.L. Denton, Southern Railway,
P.B. Armstrong, Union Pacific Railroad,
A.J. Dolby, Dolby and Associates,

and to all the committee chairmen, who, with the loyal cooperation of the committee members, prepared the interesting and instructive reports that have been presented.

Be it further resolved that a very special thanks is expressed to Frank Semans, President of REMSA, and to all members of the Railway Engineering Maintenance Suppliers Association for the fine reception that we enjoyed on Tuesday evening. Our thanks is also expressed to Mrs. Dave Staplin and Mrs. Jim Williams and their committee for their efforts in arranging registration and entertainment for our wives. Our thanks also to the management and staff of the Dallas Convention Center and the Hyatt Regency. We also thank the Southern Pacific and the Santa Fe Railroads who lent assistance to our registration desk during the conference. A special thanks goes to Pat Weissmann and Brenda Gilmore. Without their unselfish assistance, and they go beyond the call of duty, these two associations would have great difficulty functioning.

And be it finally resolved that both associations express their heartfelt thanks to the outgoing presidents, Dave Staplin and Jim Williams, who have spent so much time and effort in guiding the activities of our associations with great efficiency and dedication during the past year.

I move these resolutions be adopted.

Respectfully submitted,

J.G. Wood, Chairman
Resolutions Committee

President Staplin: Thank you, Jerry. May I have a second to the motion?

Member: So moved.

President Staplin: All in favor? (Affirmative response). All opposed? (No response). The motion is carried and will be so recorded.

President Staplin: At this time I would like to call on our immediate past presidents, Mr.

Huburt V. Meek for the Roadmasters and Mr. Jim Budzileni of the Bridge and Building Association.

INSTALLATION OF OFFICERS

Mr. Meek: Good morning. Mr. President and members, the following is a list of officers elect of the Roadmasters and Maintenance of Way Association of America for the administrative year of 1985-1986. I would like to call on the following to step forward in front of the podium and face the audience.

For Directors for the term expiring 1989:

H.J. Fuller, Assistant Engineer Standards, Chessie System, Huntington, West Virginia;

L.D. Chamberlain, Assistant Division Engineer, Union Pacific System, Green River, Wyoming;

S.W. Brunner, Materials Engineer, Illinois Central Gulf Railroad, Chicago, Illinois;

For Treasurer:

L.H. Kelley, Regional Engineer, Seaboard System Railroad, Jacksonville, Florida;

For Second Vice President:

R.E. Snyder, Assistant Chief Engineer Maintenance, Chicago and North Western Transportation Company, Chicago, Illinois;

For First Vice President:

M.J. Marlow, Supervising Engineer Tracks and Property, Elgin, Joliet and Eastern Railway Company, Joliet, Illinois;

For President:

C.W. Moorman, Division Engineer, Southern Railway, Greensboro, North Carolina;

Mr. Budzileni.

Mr. Budzileni: Thank you, Huburt. Ladies and gentlemen, the following is a list of officers elect for the American Railway Bridge and Building Association for the administrative year 1985-1986. Will the so-named officers please step forward and take the position on my left.

President:

D.A. Bessey, retired Assistant Chief Engineer Structures, Milwaukee Road, now Senior Architect, Envirodyne Engineers, Chicago, Illinois;

Senior Vice President:

J.T. Kapp, Project Manager Construction, Conrail, Philadelphia, Pennsylvania;

Junior Vice President:

D.J. Lewis, Senior Structural Designer, Illinois Central Gulf Railroad, Chicago, Illinois;

Junior Vice President:

R.A. Tallent, Process Engineer, Southern Railway, Atlanta, Georgia;

Directors for term ending 1988:

D.L. Steele, B&B Supervisor, Union Pacific System, Omaha, Nebraska;

M.C. Walbrun, Manager Engineer, Amtrak, Philadelphia, Pennsylvania;

E. Bond, Chief Engineer Structures and Bridges, Norfolk and Western, Roanoke, Virginia.

With the election of officers to any organization, it is an honor not to be taken lightly. Your fellow members in electing you to your respective offices have expressed confidence in you, first that you will discharge your several duties with distinction, and second that you are willing to do so.

Mr. Meek: As officers of our associations you will represent to the citizens of this country the true meaning of railway bridge and building and roadway maintenance and construction. You will be our collective voice in the industry. Thus you will be our common bond with railway personnel throughout the United States and the world.

Mr. Budzileni: Also, as officers of our associations you represent the activities of assignments you are given — always reminding yourselves that your attitude must be a part in any undertaking sanctioned by our authorization. In this you will be adhering strictly to the constitutions and by-laws of our associations.

Mr. Meek: It is important that this bond be preserved strong and unblemished. As professional railroaders determined to give an honorable and useful accounting of our special talents to our respective companies and customers, we must present a united front in our professional endeavors. We must be examples in which people may have confidence that they may learn that they can depend upon us in matters involving the economic use of materials and property entrusted to us. Only thus shall we grow and fulfill our destinies.

Mr. Budzileni: Do you in the presence of your fellow members of our associations pledge yourself faithfully to discharge the duties of the office to which you have been elected? If so, answer "I will" and please repeat after me: I (state your name) pledge to give cheerfully and willingly of my time and talent and to serve the advancement of my association with the highest goals of achievement, a steady shining beacon. I make this pledge in humility and the need of divine guidance.

Mr. Meek: Will all members in the audience of both Associations please stand. You have heard the pledge of your officers-elect. Unless they have your wholehearted support, they will not be able to fulfill their pledge, so faithfully given. Do you, therefore, promise to support these, your officers, as they guide their respective Associations through the coming year? Will you assist them whenever you are called upon for help in understanding the various activities which they plan? Will you encourage and advise them and refrain from unjust criticism of their plans and actions? If so, answer "I will". Let these mutual pledges be our constant help to the end that our associations may be an increasingly greater force for the well being of the railroad industry.

Mr. Budzileni: Will the officers-elect please remain standing; the others may be seated. As a representative of the American Railway Bridge and Building Association I install each of you in the office to which you were elected in your association.

Mr. Meek: As a representative of the Roadmasters Association I install each of you in the office to which you were elected in your Association.

Please remain standing so that Mr. Budzileni and I may come down and congratulate you and the audience may applaud.

(Applause)

President Staplin: Thank you, gentlemen. You may be seated. At this time it is my pleasure to call on Mr. Frank Semans, President of REMSA.

Mr. Semans: Thank you, Dave.

Mr. Moorman, Mr. Bessey, members of the Roadmasters and Bridge and Building Associations, ladies and guests. It is a distinct pleasure for me as President of REMSA to congratulate your associations on their selection of new officers and members of your boards. I certainly would be remiss if I did not thank Dave Staplin and Jim Williams and all members of their Boards, plus Pat Weissmann and Brenda Gilmore for the excellent cooperation REMSA has received in the past year. We feel certain that this spirit of cooperation will continue. As most of you know, it has been customary at this time each year for REMSA to present the incoming presidents with a gavel symbolic of authority during the upcoming term of office. Therefore I would like to present this gavel to Mr. Wick Moorman, president-elect of the Roadmasters and Maintenance of Way Association of America.

Mr. Moorman: Thank you, Frank.

Mr. Semans: And now I would like to present this gavel to Don Bessey, president-elect of the Bridge and Building Association.

Mr. Bessey: Thank you, Frank.

Mr. Semans: Congratulations to both of you. I know that you will use the gavels wisely and well. Thank you very much.

President Staplin: I would like to make a couple of final remarks. The first is that I would like to thank all the membership of the Roadmasters for the opportunity of serving you this year. By far, I'm sure I've gotten more out of it than I've been able to give through the association with the membership and the many fine, fine officers and directors of the Association. As I've said several times, with an Executive Board like we have, it makes the President's job easier, and without them the job just couldn't get done. At this time I would like to call on President-elect Moorman. You know I've been hearing all my life in the Northeast about how great the Southern Railway is and when I moved south to Jacksonville to work for the Seaboard I found about everything I had heard was true, which is unusual. Normally when someone brags you can take about 20 percent of it at face value, but the Southern truly is a formidable competitor, and it's beneficial for us because it certainly made us a lot tougher in order to compete with them and just try and stay even.

I think a good deal of that can be attributed to the quality of people on the Southern that I've been fortunate to meet and be associated with, and I'd like to say that Wick Moorman embodies all those qualities. It's a proud moment for me at this time as a friend and a competitor to present him with his President's pin.

(Applause)

President-elect Moorman: Thank you, Dave. As a friend I welcomed him putting the pin on me; as a competitor I was kind of afraid of how deep he would shove it! (Laughter)

Thank you very much. It's a great honor for me to be up here and I mean that extremely sincerely, and what Dave said about the Southern goes in turn for the Seaboard, and the most difficult thing this year will be for me to try to live up to my predecessors in this office, most particularly Dave Staplin. And at this time I really want to thank Dave for the job he's done all year and in getting ready for his conference and to present him with this handsome plaque, which I'll read. ''Appreciation Award Presented by the Roadmasters and Maintenance of Way Association of America to D.E. Staplin for His Services as President, 1984-1985''.

Mr. Staplin: Thank you, Wick, and I thank the Association and wish you good luck next year.

President-elect Moorman: Most speeches start out with a humorous story and then get to the serious substance and those of you who know me might not be surprised to know that I'll tell a little story and probably skip the substance.

Being up here reminds me a little bit about the little boy who went to first grade. On the first day of class the teacher wanted to get an idea of what they knew. So she asked each little boy and girl to stand up and say their name and if they knew how to spell it to do so. So the first little boy stands up and he says ''Bob, B-O-B.'' Teacher says, ''Fine.'' The little girl stands up behind him and says ''Sue, S-U-E.'' Everything is just fine, and there's another little boy, and he stands up and says ''Damn it. D-a-m-n'' and the teacher is shocked and she says ''Stop it right there. We won't have a conversation like that in this class'' and the little boy says ''I'm sorry Teacher, I can't help it. It really is my name. You can call my parents, but that's my name.'' She doesn't buy that for a minute and she drags him down to the Principal's office by the scruff of his neck. They call home and talk to his parents and sure enough, that's his name. So the teacher decided she just had to live with it. Things went along all right after that. And about six months later the School Superintendent comes to school, and he wants to sit in each class for a few minutes and just observe things. Teacher wants to show her little children off and she says ''All right, I want each little boy and girl to stand up and say a word that they know, and then spell it.'' Very simple. Little Bob, the first boy, stands up and says ''Cat, C-A-T.'' The teacher applauded, and the Superintendent smiles, and Sue stands up and she says ''Dog, D-O-G.'' Everything is just great. Third little boy stands up and says ''Mississippi, M-I-S-S'' and the teacher interrupts him and says ''Damn It, you can't spell that!'' And the Superintendent says ''Ah Hell, teacher, let him try!'' (Laughter)

So, Pat, you won't have to take that one out of the Proceedings!

I'm going to try like little ''Damn It'' to do the very best that I can for the Roadmasters Association. The Roadmasters Association has a kind of unique place in our industry, and it's one that I've though a lot about in the past year or so and one that I think we need to do a lot of work to clarify and resolve. It's the only organization in our industry which aims at the practicing engineer, track engineer and track supervisor or roadmaster. It's function is completely different from the AREA, and the problem that we face is how we can best fill that goal. We have two problems, one is finding the things that are going on that other people should know about, would be interested to know about, and who would benefit from learning, and the second problem is presenting them in a way that we can reach our membership. Not everybody can come to these shows, it's just a fact of life. But in the next year we are going to be looking at these problems and I'd really appreciate all the help that you can give me. We couldn't have a better Board as far as people who are hard-working, energetic, enthusiastic, and bright, but we need the help from everyone to make this organization a good organization, a better organization, and to fulfill the goals and the roles in which it fits.

That's all I've got to say really. I'm proud to be here, and I hope that I can do the best possible job. I want to congratulate everyone else, the new officers of both Associations, and, in closing, I'd like to remind Roadmasters officers that there will be a meeting after adjournment.

President Williams: Thank you, Wick. At the inauguration earlier I heard a bunch of ''I wills'' out there. Here's a subject card. You just pledged you were going to send back in, whether you know it or not. So all you people just fill them out, and mail them back in, or drop them off at the back table.

It's been a great year. I had a great Board to work with. Don Bessey was my program chairman and really we worked a lot together. Don carried the load. John Kapp was the Special

Feature Chairman, Don Lewis was the Special Subjects Chairman, Tom Kuhn did a fantastic job at the registration desk, and Byron did a fantastic job with the ladies. And of course, who can forget Pat and Brenda and Frances Dachs, who comes with us, takes her vacation, and comes down each conference, and helps handle the ladies like no one else can. I think we need a special thanks for all of those people.

At this time I would like to turn the rostrum over to Don Bessey, President-elect. Don.

President-elect Bessey: Thank you, Jim. And I would also like to thank all the members of the Executive Committee and all the members of the American Railway Bridge and Building Association for this honor. As of June 30th of this year, about five days short of 36 years I retired from the Milwaukee Road. Now I wasn't presented with a gold watch from the company but they did give me a few tokens that are probably a little more negotiable than a gold watch! But the honor of being elected President of this Association by your peers is probably one of the greatest "gold watches" that anyone could ever receive. I can single out a lot of people over the years that have been influential in my activities on the B&B Association. Wally Sturm has been a long-time associate on Committee 6 of AREA, but he always told me to get involved in B&B. Omer Denz, also a past president, always said to join the B&B. Omer was a co-worker of mine for those 36 years on the Milwaukee and is retired supervisor of maintenace. So I did get involved, and I did join, and now with gratitude and humility I accept this challenge. And last but not least I would like Marge to stand up. My wife Marge. (Applause) She and the other ladies who got all the other gals together on the buses and Marge worked for eight hours registering people on Sunday, so Marge and all these wives are a big part of the B&B and the Roadmasters Associations and we certainly thank them.

Now on behalf of the Association and myself I want to thank Jim Williams for his dedicated service to the B&B Association. Not only for the twelve months that he served as President but for the many years that he served this Association. Jim, you are a credit to the Association and a credit to the railroad industry. I've enjoyed working with you. We've had a few problems, but evidently those problems got worked out, because the conference turned out to be a tremendous success. So now, Jim, I would like to present this to you. It says "Presented to J.M. Williams for His Services as President 1984-1985 and Vice President, 1981-1984". Jim.

President Williams: Don, thank you very much. I wouldn't have gotten it without an Executive Board that worked. Thank you.

(Applause)

President-elect Bessey: Jim, you certainly have served our association well, and we, of course, will continue to use up some of your time, because you will remain on the Executive Committee for the coming year.

I also want to congratulate our Senior Vice President, John Kapp. John certainly had a busy year as Special Feature Chairman, but he also did a little work for Conrail in restoring that culvert that you saw in his presentation yesterday.

I would like to acknowledge Junior Vice President Don Lewis, in charge of Special Subjects activities and also to congratulate Ray Tallent for his election to Junior Vice President. And I congratulate the new directors who have become a part of the B&B Executive Committee. I'm sure that all of you will find out that we are a working Executive Committee. When Wally and Omer talked me into becoming a member of the B&B I did not know who did all the work, but I found out!

And now to the entire membership I repeat what Jim just said. You pledged now to fill out these cards, because I think that in some years past, a lot of cards weren't filled out, and some of these committees were pretty small. I'd like to see the special subjects presentations made up of information that was gained from many railroads, not just one or two. So fill out the cards and hand them to Brenda at the door on the way out, or give them to any Board member.

I'd also wish like everyone else has done, to express my appreciation to REMSA, the suppliers, for their help and hospitality during this conference. I hope the Railway Engineering Maintenance Suppliers' exhibit will reap benefits far beyond their expectations.

And last but not least, and everybody else has done the this too, but I have to do it, I must extend my gratitude to Pat Weissmann for the excellent job well done and her very able assistant, new girl on the job, Brenda Gilmore, because without their excellent performance to the

B&B and Roadmasters and Superintendents Associations we would be in big trouble. I worked with Pat for a long time, serving as Senior Vice President, two years as Junior Vice President, and served on the Joint Association Committee for three or four years. In this time Pat and I have carried out some monumental accomplishments, one of which that we've lived through and conquered was the duplicating machine syndrome, that's an inside joke but I think there are enough people here who know what I'm talking about.

So in closing, let me again remind the Executive Committee of the B&B that we'll have a short meeting right after adjournment.

So once again I extend my gratitude to you for giving me the honor of serving you as your president. Thank you very much.

(Applause)

President Moorman: Members and guests, if there are no other matters to be brought before this session, I declare the 97th Annual Conference of the Roadmasters and Maintenance of Way Association of America and the 90th Annual Conference of the American Railway Bridge and Building Association adjourned.

(Applause)

INSTALLATION OF OFFICERS

Left to right: **Roadmasters:** C.W. Moorman, President; S.W. Brunner, Director; L.R. Chamberlain, Director; R.E. Snyder, Second Vice President; M.J. Marlow, First Vice President; H.J. Fuller, Director. **Bridge & Building:** D.A. Bessey, President; D.J. Lewis, Junior Vice President; R.A. Tallent, Junior Vice President; W.P. Cunningham, Director; D.L. Steele, Director; M.C. Walbrun, Director.

Past Officers

	1891-1892	1892-1893	1893-1894	1894-1895
President	O. J. Travis	H. M. Hall	J. E. Wallace	Geo. W. Andrews
1st V.-Pres.	H. M. Hall	J. E. Wallace	Geo. W. Andrews	W. A. McGonagle
2nd V.-Pres.	J. B. Mitchell	G. W. Hinman	W. A. McGonagle	L. K. Spafford
3rd V.-Pres.	James Stannard	N. W. Thompson	L. K. Spafford	James Stannard
4th V.-Pres.	G. W. Hinman	C. T. Fuller	E. D. Hines	Walter G. Berg
Secretary	C. W. Gooch	S. F. Patterson	S. F. Patterson	S. F. Patterson
Treasurer	George M. Reid	George M. Reid	George M. Reid	George M. Reid
Executive Members	W. R. Damon G. W. Markley W. A. McGonagle C. W. McGehee G. W. Turner J. E. Wallace	G. W. Andrews J. M. Staten J. M. Caldwell Q. McNab Floyd Ingram A. S. Markley	Q. McNab A. S. Markley Floyd Ingram James Stannard James H. Travis J. H. Cummin	James Stannard James H. Travis J. H. Cummin R. M. Peck J. L. White A. Shane

	1895-1896	1896-1897	1897-1898	1898-1899
President	W. A. McGonagle	James Stannard	Walter G. Berg	J. M. Cummin
1st V.-Pres.	L. K. Spafford	Walter G. Berg	J. H. Cummin	A. S. Markley
2nd V.-Pres.	James Stannard	J. H. Cummin	A. S. Markley	C. C. Mallard
3rd V.-Pres.	Walter G. Berg	A. S. Markley	G. W. Hinman	W. A. Rogers
4th V.-Pres.	J. H. Cummin	R. M. Peck	C. C. Mallard	J. M. Staten
Secretary	S. F. Patterson	S. F. Patterson	S. F. Patterson	S. F. Patterson
Treasurer	George M. Reid	N. W. Thompson	N. W. Thompson	N. W. Thompson
Executive Members	R. M. Peck L. J. White A. Shane A. S. Markley W. M. Noon J. M. Staten	W. O. Eggleston W. M. Noon J. M. Staten G. J. Bishop C. P. Austin M. Riney	G. J. Bishop C. P. Austin M. Riney Wm. S. Danes J. H. Markley W. O. Eggleston	Wm. S. Danes J. H. Markley W. O. Eggleston R. L. Heflin F. W. Tanner A. Zimmerman

	1899-1900	1900-1901	1901-1902	1902-1903
President	Aaron S. Markley	W. A. Rogers	W. S. Danes	B. F. Pickering
1st V.-Pres.	W. A. Rogers	W. S. Danes	B. F. Pickering	C. C. Mallard
2nd V.-Pres.	J. M. Staten	B. G. Pickering	A. Shane	A. Shane
3rd V.-Pres.	Wm. S. Danes	A. Shane	A. Zimmerman	A. Zimmerman
4th V.-Pres.	B. F. Pickering	A. Zimmerman	C. C. Mallard	A. Montzheimer
Secretary	S. F. Patterson	S. F. Patterson	S. F. Patterson	S. F. Patterson
Treasurer	N. W. Thompson	N. W. Thompson	N. W. Thompson	N. W. Thompson
Executive Members	T. M. Strain R. L. Heflin F. W. Tanner A. Zimmerman H. D. Cleaveland A. Montzheimer	T. M. Strain H. D. Cleaveland F. W. Tanner A. Montzheimer W. E. Smith A. W. Merrick	A. Montzheimer W. E. Smith A. W. Merrick C. P. Austin C. A. Lichty W. O. Eggleston	W. E. Smith A. W. Merrick C. P. Austin C. A. Lichty W. O. Eggleston J. H. Markley

	1903-1904	1904-1905	1905-1906	1906-1907
President	A. Montzheimer	C. A. Lichty	J. B. Sheldon	J. H. Markley
1st V.-Pres.	A. Shane	J. B. Sheldon	J. H. Markley	R. H. Reid
2nd V.-Pres.	C. A. Lichty	J. H. Markley	R. H. Reid	J. P. Canty
3rd V.-Pres.	J. B. Sheldon	R. H. Reid	R. C. Sattley	H. Rettinghouse
4th V.-Pres.	J. H. Markley	R. C. Sattley	J. P. Canty	F. E. Schall
Secretary	S. F. Patterson	S. F. Patterson	S. F. Patterson	S. F. Patterson
Treasurer	C. P. Austin	C. P. Austin	C. P. Austin	C. P. Austin
Executive Members	R. H. Reid W. O. Eggleston A. E. Killam R. C. Sattley H. Rettinghouse J. S. Lemond	W. O. Eggleston A. E. Killam H. Rettinghouse J. S. Lemond W. H. Finley C. W. Richey	H. Rettinghouse A. E. Killam J. S. Lemond C. W. Richey W. O. Eggleston F. E. Schall	W. O. Eggleston A. E. Killam J. S. Lemond C. W Richey H. H. Eggleston B. J. Sweatt

	1907-1908	1908-1909	1909-1910	1910-1911
President	R. H. Reid	J. P. Canty	H. Rettinghouse	H. Rettinghouse
1st V.-Pres.	J. P. Canty	H. Rettinghouse	J. S. Lemond	F. E. Schall
2nd V.-Pres.	H. Rettinghouse	F. E. Schall	F. E. Schall	A. E. Killam
3rd V.-Pres.	F. E. Schall	J. S. Lemond	A. E. Killam	J. N. Penwell
4th V.-Pres.	W. O. Eggleston	A. E. Killam	J. N. Penwell	L. D. Hadwen
Secretary	S. F. Patterson	S. F. Patterson	C. A. Lichty	C. A. Lichty
Treasurer	C. P. Austin	C. P. Austin	J. P. Canty	J. P. Canty
Executive Members	A. E. Killam J. S. Lemond C. W. Richey T. S. Leake W. H. Finley J. N. Penwell	J. N. Penwell Willard Beahan F. B. Scheetz W. H. Finley L. D. Hadwen T. J. Fullem	W. Beahan F. B. Scheetz L. D. Hadwen T. J. Fullem G. Aldrich P. Swenson	T. J. Fullem G. Aldrich P. Swenson G. W. Rear W. O Eggleston W. F. Steffens

	1911-1912	1912-1913	1913-1914	1914-1915
President	F. E. Schall	A. E. Killam	J. N. Penwell	L. D. Hadwen
1st V.-Pres.	A. E. Killam	J. N. Penwell	L. D. Hadwen	G. Aldrich
2nd V.-Pres.	J. N. Penwell	L. D. Hadwen	G. Aldrich	G. W. Rear
3rd V.-Pres.	L. D. Hadwen	T. J. Fullem	G. W. Rear	C. E. Smith
4th V.-Pres.	T. J. Fullen	G. Aldrich	C. E. Smith	E. B. Ashby
Secretary	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Treasurer	J. P. Canty	J. P. Canty	J. P. Canty	F. E. Weise
Executive Members	G. Aldrich	G. W. Rear	W. F. Steffens	W. F. Steffens
	P. Swenson	W. F. Steffens	E. B. Ashby	S. C. Tanner
	G. W. Rear	E. B. Ashby	S. C. Tanner	Lee Jutton
	W. F. Steffens	C. E. Smith	Lee Jutton	F. F. Strouse
	E. B. Ashby	S. C. Tanner	W. F. Strouse	C. R. Knowles
	W. O. Eggleston	Lee Jutton	C. R. Knowles	A. Ridgway

	1915-1916	1916-1917	1917-1918	1918-1919
President	G. W. Rear	C. E. Smith	S. C. Tanner	Lee Jutton
1st V.-Pres.	C. E. Smith	E. B. Ashby	Lee Jutton	F. E. Weise
2nd V.-Pres.	E. B. Ashby	S. C. Tanner	F. E. Weise	W. F. Strouse
3rd V.-Pres.	S. C. Tanner	Lee Jutton	W. F. Strouse	C. R. Knowles
4th V.-Pres.	Lee Jutton	F. E. Weise	C. R. Knowles	A. Ridgway
Sec.-Treas.	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Executive Members	F. E. Weise	W. F. Strouse	A. Ridgway	J. S. Robinson
	W. F. Strouse	C. R. Knowles	J. S. Robinson	J. P. Wood
	C. R. Knowles	A. Ridgway	J. P. Wood	A. B. McVay
	A. Ridgway	J. S. Robinson	D. C. Zook	J. H. Johnston
	J. S. Robinson	J. P. Wood	A. B. McVay	E. T. Howson
	J. P. Wood	D. C. Zook	J. H. Johnston	C. W. Wright

	1919-1920	1920-1921	1921-1922	1922-1923
President	F. E. Weise	W. F. Strouse	C. R. Knowles	Arthur Ridgway
1st V.-Pres.	W. F. Strouse	C. R. Knowles	A. Ridgway	J. P. Wood
2nd V.-Pres.	C. R. Knowles	A. Ridgway	J. S. Robinson	J. S. Robinson
3rd V.-Pres.	A. Ridgway	J. S. Robinson	J. P. Wood	C. W. Wright
4th V.-Pres.	J. S. Robinson	J. P. Wood	C. W. Wright	E. T. Howson
Sec.-Treas.	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Asst. Sec.			F. E. Weise	F. E. Weise
Directors	J. P. Wood	C. W. Wright	E. T. Howson	F. C. Baluss
	A. B. McVay	A. B. McVay	J. H. Johnson	Maro Johnson
	J. H. Johnston	G. A. Manthey	E. K. Barrett	O. F. Dalstrom
	E. T. Howson	E. T. Howson	F. C. Baluss	S. D. Corey
	C. W. Wright	J. H. Johnston	Maro Johnson	W. B. Hotson
	G. A. Manthey	E. K. Barrett	O. F. Dalstrom	P. N. Nelson

	1923-1924	1924-1925	1925-1926	1926-1927
President	J. S. Robinson	J. P. Wood	C. W. Wright	E. T. Howson
1st V.-Pres.	J. P. Wood	C. W. Wright	E. T. Howson	F. C. Baluss
2nd V.-Pres.	C. W. Wright	E. T. Howson	F. C. Baluss	Maro Johnson
3rd V.-Pres.	E. T. Howson	F. C. Baluss	Maro Johnson	J. S. Huntoon
4th V.-Pres.	F. C. Baluss	Maro Johnson	J. S. Huntoon	C. S. Heritage
Sec.-Treas.	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Asst. Sec.	F. E. Weise	F. E. Weise	F. E. Weise	F. E. Weise
Directors	S. T. Corey	J. S. Huntoon	C. S. Heritage	A. I. Gauthier
	W. B. Hotson	A. I. Gauthier	W. B. Hotson	E. L. Sinclair
	P. N. Nelson	E. L. Sinclair	P. N. Nelson	P. F. Dalstrom
	J. S. Huntoon	C. S. Heritage	A. I. Gauthier	W. T. Krausch
	A. I. Gauthier	W. B. Hotson	E. L. Sinclair	R. C. Bardwell
	E. L. Sinclair	P. N. Nelson	O. F. Dalstrom	H. I. Benjamin

	1927-1928	1928-1929	1929-1930	1930-1934
President	F. C. Baluss	Maro Johnson	J. S. Huntoon	C. S. Heritage
1st V.-Pres.	Maro Johnson	J. S. Huntoon	C. S. Heritage	A. I. Gauthier
2nd V.-Pres.	J. S. Huntoon	C. S. Heritage	A. I. Gauthier	H. I. Benjamin
3rd V.-Pres.	C. S. Heritage	A. I. Gauthier	H. I. Benjamin	W. T. Krausch
4th V.-Pres.	A. I. Gauthier	H. I. Benjamin	W. T. Krausch	T. H. Strate
Sec.-Treas.	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Asst. Sec.	F. E. Weise	F. E. Weise		
Directors	W. T. Krausch	R. C. Henderson	G. A. Rodman	E. C. Neville
	R. C. Bardwell	J. S. Ekey	W. A. Batey	H. H. Best
	H. I. Benjamin	T. H. Strate	F. W. Hillman	J. E. King
	R. C. Henderson	G. A. Rodman	E. C. Neville	A. B. Scowden
	T. H. Strate	W. A. Batey	H. H. Best	W. A. Batey
	J. S. Ekey	F. W. Hillman	J. E. King	L. C. Smith

	1934–1935	1935–1936	1936–1937	1937–1938
President	H. I. Benjamin	T. H. Strate	E. C. Neville	C. M. Burpee
1st V.-Pres.	T. H. Strate	E. C. Neville	C. M. Burpee	F. H. Masters
2nd V.-Pres.	E. C. Neville	C. M. Burpee	F. H. Masters	W. S. Lacher
3rd V.-Pres.	A. B. Scowden	F. H. Masters	C. A. J. Richards	C. A. J. Richards
4th V.-Pres.	W. R. Roof	C. A. J. Richards	W. S. Lacher	F. H. Cramer
Sec.-Treas.	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Directors	C. M. Burpee	A. L. McCloy	W. R. Roof	B. R. Meyers
	W. A. Batey	R. P. Luck	T. P. Soule	G. S. Crites
	L. C. Smith	H. H. Best	F. H. Cramer	R. E. Dove
	C. A. J. Richards	W. R. Roof	B. R. Meyers	T. P. Soule
	A. L. McCloy	T. P. Soule	G. S. Crites	A. Chinn
	R. P. Luck	F. H. Cramer	R. E. Dove	L. G. Byrd

	1938–1939	1939–1940	1940–1941	1941–1942
President	Armstrong Chinn	A. E. Bechtelheimer	H. M. Church	R. E. Dove
1st V.-Pres.	F. H. Cramer	F. H. Cramer	R. E. Dove	F. H. Soothill
2nd V.-Pres.	A. E. Bechtelheimer	H. M. Church	F. A. Soothill	G. S. Crites
3rd V.-Pres.	H. M. Church	R. E. Dove	G. S. Crites	A. M. Knowles
4th V.-Pres.	R. E. Dove	F. H. Soothill	A. M. Knowles	N. D. Howard
Sec.-Treas.	C. A. Lichty	C. A. Lichty		
Secretary	....	....	F. O. Whiteman	A. G. Shaver
Treasurer	....	....	F. E. Weise	F. E. Weise
Directors	L. G. Byrd	B. R. Meyers	N. D. Howard	R. E. Caudle
	W. R. Ganser	W. Walkden	L. G. Byrd	I. A. Moore
	F. H. Soothill	A. S. Krefting	K. L. Miner	W. A. Sweet
	B. R. Meyers	A. M. Knowles	R. E. Caudle	J. L. Varker
	W. Walkden	L. G. Byrd	I. A. Moore	L. E. Peyser
	A. S. Krefting	K. L. Miner	W. A. Sweet	Martin Meyer

	1942–1943	1943–1944	1944–1945	1945–1946
President	G. S. Crites	J. L. Varker	J. L. Varker	N. D. Howard
1st V.-Pres.	R. E. Caudle	R. E. Caudle	R. E. Caudle	F. G. Campbell
2nd V.-Pres.	A. M. Knowles	N. D. Howard	N. D. Howard	J. S. Hancock
3rd V.-Pres.	N. D. Howard	F. G. Campbell	F. G. Campbell	E. H. Barnhart
4th V.-Pres.	J. L. Varker	J. S. Hancock	J. S. Hancock	W. F. Martens
Secretary	A. G. Shaver† Lorene Kindred‡ Elinor V. Heffern	Elinor V. Heffern	Elise LaChance	Elise LaChance
Treasurer	F. E. Weise	C. R. Knowles	C. R. Knowles	C. R. Knowles
Treasurer Emeritus		F. E. Weise	F. E. Weise	
Directors	M. Meyer	W. F. Martens	W. F. Martens	A. B. Chapman
	L. E. Peyser	A. L. McCloy	A. L. McCloy	W. A. Huckstep
	K. L. Miner	L. C. Winkelhaus	L. C. Winkelhaus	F. R. Spofford
	F. G. Campbell	E. H. Barnhart	E. H. Barnhart	Guy E. Martin
	J. S. Hancock	A. B. Chapman	A. B. Chapman	B. R. Meyers
	L. C. Winkelhaus	L. E. Peyser	L. E. Peyser	L. E. Peyser

† To November 1, 1942 ‡ To February 1, 1943

	1946–1947	1947–1948	1948–1949	1949–1950
President	F. G. Campbell	J. S. Hancock	E. H. Barnhart	W. F. Martens
1st V.-Pres.	J. S. Hancock	E. H. Barnhart	W. F. Martens	W. A. Huckstep
2nd V.-Pres.	E. H. Barnhart	W. F. Martens	W. A. Huckstep	Guy E. Martin
3rd V.-Pres.	W. F. Martens	W. A. Huckstep	Guy E. Martin	F. R. Spofford
4th V.-Pres.	W. A. Huckstep	G. E. Martin	F. R. Spofford	Lee Mayfield
Secretary	Elise LaChance	Elise LaChance	Elise LaChance	Elise LaChance
Treasurer	C. R. Knowles	C. R. Knowles	L. C. Winkelhaus	L. C. Winkelhaus
Directors	Guy E. Martin	H. M. Harlow	Lee Mayfield	H. M. Harlow
	B. R. Meyers	H. B. Christianson	F. M. Misch	V. E. Engman
	L. E. Peyser	F. R. Spofford	W. D. Gibson	G. W. Benson
	H. M. Harlow	Lee Mayfield	H. M. Harlow	F. M. Misch
	H. B. Christianson	Franz M. Misch	V. E. Engman	L. R. Morgan
	F. R. Spofford	W. D. Gibson	G. W. Benson	J. A. Jorlett

	1950–1951	1951–1952	1952–1953	1953–1954
President	W. A. Huckstep	Guy E. Martin	F. R. Spofford	Lee Mayfield
1st V.-Pres.	Guy E. Martin	F. R. Spofford	Lee Mayfield	H. M. Harlow
2nd V.-Pres.	F. R. Spofford	Lee Mayfield	H. M. Harlow	J. A. Jorlett
3rd V.-Pres.	Lee Mayfield	H. M. Harlow	J. A. Jorlett	R. R. Gunderson
4th V.-Pres.	H. M. Harlow	J. A. Jorlett	R. R. Gunderson	W. H. Huffman
Secretary	Elise LaChance	Elise LaChance	Elise LaChance	Elise LaChance
Treasurer	L. C. Winkelhaus	L. C. Winkelhaus	L. C. Winkelhaus	L. C. Winkelhaus
Directors	F. M. Misch	M. H. Dick	W. H. Huffman	M. H. Dick
	L. R. Morgan	R. R. Gunderson	L. R. Morgan	J. F. Warrenfells
	J. A. Jorlett	J. F. Warrenfells	B. M. Stephens	G. Switzer
	M. H. Dick	W. H. Huffman	M. H. Dick	B. M. Stephens
	R. R. Gunderson	L. R. Morgan	J. F. Warrenfells	W. H. Bunge
	J. F. Warrenfells	B. M. Stephens	G. Switzer	E. R. Schlaf

	1954–1955	1955–1956	1956–1957	1957–1958
President	H. M. Harlow	J. A. Jorlett	R. R. Gunderson	W. H. Huffman
1st V.-Pres.	J. A. Jorlett	R. R. Gunderson	W. H. Huffman	M. H. Dick
2nd V.-Pres.	R. R. Gunderson	W. H. Huffman	M. H. Dick	B. M. Stephens
3rd V.-Pres.	W. H. Huffman	M. H. Dick	B. M. Stephens	H. D. Curie
4th V.-Pres.	M. H. Dick	B. M. Stephens	H. D. Curie	
Secretary	Elise LaChance	Elise LaChance	Elise LaChance	Elise LaChance
Treasurer	L. C. Winkelhaus	L. C. Winkelhaus	L. C. Winkelhaus	L. C. Winkelhaus
Directors	B. M. Stephens	J. F. Warrenfells	W. H. Bunge	G. W. Benson
	W. H. Bunge	H. D. Curie	E. R. Schlaf	J. M. Lowry
	E. R. Schlaf	J. M. Lowry	G. W. Benson	H. H. Matthews
	J. F. Warrenfells	W. H. Bunge	J. M. Lowry	T. M. VonSprecken
	H. D. Curie	E. R. Schlaf	T. M. VonSprecken	W. H. Bunge
	J. M. Lowry	G. W. Benson	H. A. Matthews	E. R. Schlaf

	1958–1959	1959–1960	1960–1961	1961–1962
President	M. H. Dick	B. M. Stephens	H. D. Curie	G. W. Benson
1st V.-Pres.	B. M. Stephens	H. D. Curie	G. W. Benson	J. M. Lowry
2nd V.-Pres.	H. D. Curie	G. W. Benson	J. M. Lowry	E. R. Schlaf
3rd V.-Pres.	G. W. Benson	J. M. Lowry	E. R. Schlaf	H. A. Matthews
Secretary	Ruth Weggeberg	Ruth Weggeberg	Ruth Weggeberg	Ruth Weggeberg
Treasurer	L. C. Winkelhaus	L. C. Winkelhaus	L. C. Winkelhaus	L. C. Winkelhaus
Directors	J. M. Lowry	W. H. Bunge	H. A. Matthews	R. C. Baker
	R. C. Baker	E. R. Schlaf	M. J. Hubbard	R. H. Miller
	W. H. Bunge	H. A. Matthews	R. C. Baker	Shirley White
	E. R. Schlaf	M. J. Hubbard	R. H. Miller	H. M. Wilson
	H. A. Matthews	R. C. Baker	Shirley White	R. D. Hellweg
	M. J. Hubbard	R. H. Miller	H. M. Wilson	F. W. Hutcheson

	1962–1963	1963–1964	1964–1965	1965–1966
President	J. M. Lowry	E. R. Schlaf	R. C. Baker	H. M. Wilson
1st V.-Pres.	E. R. Schlaf	R. C. Baker	H. M. Wilson	R. D. Hellweg
2nd V.-Pres.	H. A. Matthews	Shirley White	R. D. Hellweg	J. W. DeValle
3rd V.-Pres.	R. C. Baker	H. M. Wilson	J. W. DeValle	W. F. Armstrong
Secretary	Ruth Weggeberg	Ruth Weggeberg	Ruth Weggeberg	Ruth Weggeberg
Treasurer	L. C. Winkelhaus	E. F. Snyder	E. F. Snyder	E. F. Snyder
Directors	Shirley White	R. D. Hellweg	W. F. Armstrong	J. A. Goforth
	H. M. Wilson	F. W. Hutcheson	J. S. Ellis	E. R. Simmons
	R. D. Hellweg	W. F. Armstrong	J. A. Goforth	N. D. Bryant
	F. W. Hutcheson	J. W. DeValle	E. R. Simmons	A. R. Dahlberg
	W. F. Armstrong	J. A. Goforth	N. D. Bryant	J. S. Ellis
	J. W. DeValle	E. R. Simmons	A. R. Dahlberg	T. L. Fuller

	1966–1967	1967–1968	1968–1969	1969–1970
President	R. D. Hellweg	J. W. DeValle	W. F. Armstrong	J. A. Goforth
1st V.-Pres.	J. W. DeValle	W. F. Armstrong	J. A. Goforth	A. R. Dahlberg
2nd V.-Pres.	W. F. Armstrong	J. A. Goforth	A. R. Dahlberg	T. L. Fuller
3rd V.-Pres.	J. A. Goforth	A. R. Dahlberg	T. L. Fuller	N. D. Bryant
Secretary	Ruth Weggeberg	Ruth Weggeberg	Ruth Weggeberg	Ruth Weggeberg
Treasurer	W. H. Huffman	W. H. Huffman	W. H. Huffman	W. H. Huffman
Directors	N. D. Bryant	J. S. Ellis	N. F. Lucas	W. H. Rankin
	A. R. Dahlberg	T. L. Fuller	W. L. Short	E. E. Runde
	H. F. Lucas	R. A. Youngblood	C. E. Wachter	T. A. Reynolds
	J. S. Ellis	H. F. Lucas	A. C. Jones	J. J. Ridgeway
	T. L. Fuller	W. L. Short	W. H. Rankin	J. R. Williams
	R. A. Youngblood	C. E. Wachter	E. E. Runde	J. W. Chambers
	V. D. Raessler	A. C. Jones	T. A. Reynolds	R. E. Frame
	W. L. Short	W. H. Rankin	J. J. Ridgeway	J. C. Hobbs
	C. E. Wachter	E. E. Runde	J. R. Williams	

	1970–1971	1971–1972	1972–1973	1973–1974
President	A. R. Dahlberg	T. L. Fuller	N. D. Bryant	E. E. Runde
1st V.-Pres.	T. L. Fuller	N. D. Bryant	E. E. Runde	J. J. Ridgeway
2nd V.-Pres.	N. D. Bryant	E. E. Runde	J. J. Ridgeway	J. R. Williams
3rd V.-Pres.	E. E. Runde	J. J. Ridgeway	J. R. Williams	W. R. Rankin
Secretary	Ann Wilson	Ann Wilson	Ann Wilson	Ann Wilson
Treasurer	W. H. Huffman	W. H. Huffman	W. H. Huffman	W. H. Huffman
Directors	T. A. Reynolds	J. W. Chambers	R. K. Corbett	D. C. Gould
	J. J. Ridgeway	R. E. Frame	J. R. Iwinski	W. S. Stokely
	J. R. Williams	J. C. Hobbs	J. S. Pritchett	W. C. Sturm
	J. W. Chambers	R. K. Corbett	D. C. Gould	J. W. Davidson
	R. E. Frame	J. R. Iwinski	W. S. Stokely	C. A. Hughes
	J. C. Hobbs	J. S. Pritchett	W. C. Sturm	W. R. Hyma
	R. K. Corbett	D. C. Gould	J. W. Davidson	O. C. Denz
	J. R. Iwinsky	W. S. Stokely	C. A. Hughes	R. C. McMaster
	J. S. Pritchett	W. C. Sturm	W. R. Hyma	W. E. Brakensiek

	1974-1975	1975-1976	1976-1977	1977-1978
President	J. J. Ridgeway	J. R. Williams	W. H. Rankin	J. R. Iwinski
1st V.-Pres.	J. R. Williams	W. H. Rankin	J. R. Iwinski	W. C. Sturm
2nd V.-Pres.	W. H. Rankin	J. C. Hobbs	W. C. Sturm	D. C. Gould
3rd V.-Pres.	J. C. Hobbs	J. R. Iwinski	D. C. Gould	J. W. Chambers
Secretary	Ann Wilson	Ann Wilson	Ann Wilson	Ann Wilson
Treasurer	W. H. Huffman	W. H. Huffman	W. H. Huffman	W. H. Huffman
Directors	J. W. Davidson	W. E. Brakensiek	J. W. Chambers	W. J. Gunkle
	C. A. Hughes	O. C. Denz	M. Noyszewski	W. E. Halley
	W. R. Hyma	R. C. McMaster	W. J. Gunkle	K. L. Wammell
	W. E. Brakensiek	F. R. Lindsay	W. E. Halley	J. Budzileni
	O. C. Denz	M. Noyszewski	K. L. Wammel	B. J. King
	R. C. McMaster	W. C. Sturm	J. Budzileni	J. G. Robertson
	F. B. Lindsay, Jr.	W. J. Gunkle	B. J. King	O. C. Denz
	M. Noyszewski	W. E. Halley	J. G. Robertson	E. C. Patterson
	Jim Payne	K. L. Wammel		W. S. Stokely

	1978-1979	1979-1980	1980-1981	1981-1982
President	W. C. Sturm	D. C. Gould	J. W. Chambers	W. R. Hyma
Sr. V.-Pres.	D. C. Gould	J. W. Chambers	R. C. McMaster	O. C. Denz
Jr. V.-Pres.	J. W. Chambers	R. C. McMaster	W. R. Hyma	J. Budzileni
Jr. V.-Pres.	R. C. McMaster	W. R. Hyma	O. C. Denz	J. M. Williams
Secretary	Ann Wilson	Ann Wilson	Ann Wilson	Pat Weissmann
Treasurer	W. F. Armstrong	W. F. Armstrong	W. F. Armstrong	W. C. Sturm
Directors	J. Budzileni	O. C. Denz	J. W. Davidson	D. A. Bessey
	B. J. King	W. J. Gunkle	C. M. Russell	J. N. Michel
	J. G. Robertson	W. S. Stokely	J. M. Williams	P. H. Saletnik
	O. C. Denz	L. D. Green	D. A. Bessey	O. D. Anthony
	E. C. Patterson	C. M. Russell	J. N. Michel	J. T. Kapp
	W. S. Stokely	J. M. Williams	P. H. Saletnik	D. J. Lewis
	L. D. Green	D. A. Bessey	O. D. Anthony	J. W. Davidson
	C. M. Russell	J. N. Michel	J. T. Kapp	H. J. Laga
	J. M. Williams	P. H. Saletnik	D. J. Lewis	A. S. Uppal

	1982-1983	1983-1984	1984-1985
President	O. C. Denz	J. Budzileni	J.M. Williams
Sr. Vice President	J. Budzileni	J.M. Williams	D.A. Bessey
Jr. Vice President	J. M. Williams	D.A. Bessey	J.T. Kapp
Jr. Vice President	D. A. Bessey	J.T. Kapp	D.J. Lewis
Secretary	P. A. Weissmann	P.A. Weissmann	P.A. Weissmann
Treasurer	P. H. Saletnik	P.H. Saletnik	P.H. Saletnik
Directors	O. D. Anthony	J.W. Davidson	T.E. Kuhn
	J. T. Kapp	D.J. Lewis	D.R. Ladner
	D. J. Lewis	T.E. Kuhn	R.A. Tallent
	J. W. Davidson	D.R. Ladner	B.T. Burns
	H. J. Laga	R.A. Tallent	J.J. Horney
	A. S. Uppal	B.T. Burns	W.J. Semioli
	T. E. Kuhn	J.J. Horney	D.W. Brookings
	D. R. Ladner	W.J. Semioli	W.P. Cunningham
	R. A. Tallent		J.H. Smith

CONSTITUTION

ARTICLE I.

NAME

Section 1. This association shall be known as the American Railway Bridge & Building Association.

ARTICLE II.

OBJECT

Section 1.** The object of this association shall be the advancement of knowledge pertaining to the design, construction and maintenance of railway bridges, buildings, water service facilities, and other structures, by investigation, reports and discussions.

Section 2. The association shall neither endorse nor recommend any particular devices, trade marks or materials, nor will it be responsible for any opinions expressed in papers, reports or discussion unless the same have received the endorsement of the association in regular session.

ARTICLE III.

MEMBERSHIP

Section 1.* The membership of this association shall be divided into four classes, viz: Members, life members, associate members and honorary members.

Section 2.* A member shall be a person in a position above rank of gang foreman in connection with engineering, construction and maintenance for railway bridges, buildings and water service facilities: or in the employ of a public regulatory body, a professor of engineering or architecture, a technical editor, a government or private timber expert, a consulting engineer, or an engineer in his employ, engaged in the engineering, construction and maintenance of railroad-related facilities or an engineer employed by a technical service or research and development organization, an officer or engineer of an engineering or scientific society or association whose aims and objectives are compatible with the aims and objectives of this association. Any person desirous of becoming a member shall make application upon the form prescribed by the executive committee, setting forth his name, age, residence and practical experience. He shall furnish at least three references to whom he is personally known. Applicants may be voted into membership at any regular executive meeting or by letter ballot of the executive committee, a majority vote being necessary in either instance.

Section 3.** To be eligible for a life membership a member must have belonged to the association for at least 15†† years and in general must have retired from active railway service due to age or physical disability. He shall have all the privileges of membership, except the holding of office, and shall not be required to pay annual dues. The transfer from membership to life membership shall be made in the same manner as the election of members, as prescribed in Section 2, of this Article.

Section 4. Associates shall be responsible persons who are not eligible as members, whose pursuits or attainments qualify them to co-operate with members in the study and development of improved practices in the construction and maintenance of bridges, buildings and water facilities. They shall have all the rights of members except of voting and holding office. They shall be elected in the manner prescribed for members, in Section 2 of this Article.

---

*Amended September, 1976.
**Amended September 20, 1948
††Amended March 10, 1958.

Section 5. Honorary members shall be chosen from persons who have attained acknowledged eminence in some branch of engineering or railway service. Their number shall be limited to ten. Honorary members shall be proposed by not less than six active members and shall be elected by the unanimous vote of the members present at a regular meeting. They shall have all the rights of members except that of holding office and shall be exempt from the payment of dues.

Section 6. Any member guilty of conduct unbecoming to a railroad officer and a member of this association, or who shall refuse to comply with the rules of this association, shall forfeit his membership on a two-thirds vote of the executive committee.

Section 7. Membership shall continue until written resignation is received by the secretary, unless member has been previously expelled, or dropped for non-payment of dues in accordance with Section 1 of Article VII.

Section 8.** Only members shall hold office in this association, and only members and life members shall be entitled to vote in the election of officers.

ARTICLE IV.

OFFICERS

Section 1‡‡. The officers of the Association shall be a President, two Junior Vice Presidents, a Senior Vice President, a Treasurer and nine Directors, who, with the most recent Past President, shall constitute the Executive Committee.

Section 2. The past presidents of this association, previous to the most recent past president, who continue to be members shall be privileged to attend all meetings of the executive committee, of which meetings they shall receive due notice, and be permitted to discuss all questions and to aid said committee by their advice and counsel; but said past presidents shall not have a right to vote, unless called upon to fill a quorum.

Section 3. Vacancies in any office shall be filled for the unexpired term by the executive committee without delay.

ARTICLE V.

EXECUTIVE COMMITTEE

Section 1.** The executive committee shall manage the affairs of the association and shall have full power to control and regulate all matters not otherwise provided for in the constitution and by-laws and shall exercise general supervision over the financial interests of the association, and make all necessary purchases and contracts required to conduct the general business of the association, but shall not have the power to render the association liable for any debt beyond the amount then in the treasury plus accounts receivable and not subject to other prior liabilities. All appropriations for special purposes must be acted upon at a regular meeting of the association.

Section 2. Meetings of the executive committee may be called by a majority of the members of the committee, providing 10 days' notice is given members by mail.

Section 3. Five members of the executive committee shall constitute a quorum for the transaction of business.

ARTICLE VI.

ELECTION OF OFFICERS AND SECRETARY AND TENURE OF OFFICE

Section 1. Except as otherwise provided the officers shall be elected at the regular annual meeting of the association and the election shall not be postponed except by unanimous consent of the members present at said annual meeting. The election shall be by ballot, a majority of the votes cast being required for election. Any member of the association not in arrears for dues shall be eligible for office, but the president shall not be eligible for re-election.

---

*Amended October 16, 1941.

†Amended September 21, 1957.

‡Amended September 28, 1966.

‡‡Amended September 20, 1978.

° Amended October 7, 1982.

Section 2††. The President, two Junior Vice Presidents, and Treasurer shall hold office for one year and the Directors for three years; three Directors being elected each year. The Senior Vice President shall hold office for one year and ascend to the office of President at the expiration of such service. All officers shall retain their office until their successors are elected and installed. A Director elected for a three-year term shall not be eligible to serve two consecutive terms.

Section 3.° The term of office of the treasurer may be terminated at any time by two-thirds vote of Executive Committee. The compensation of the treasurer shall be fixed by a majority vote of the Executive Committee.

Section 4.° The secretary shall be appointed by a majority vote of the Executive Committee and the term shall terminate with the appointment of successor. The Executive Committee shall have the power, by two-thirds vote, to remove the secretary and appoint successor at any time. The salary of the secretary shall be decided by a majority vote of the Executive Committee.

Section 5.° The secretary and the treasurer shall be required to give bond in an amount to be fixed by the Executive Committee.

ARTICLE VII.

MEMBERSHIP FEE AND DUES

Section 1†. Every member upon joining this association shall pay to the secretary an entrance fee and dues as prescribed by the executive committee. No member in arrears for annual dues shall be entitled to vote at any election and any member more than one year in arrears, may be stricken from the list of members at the discretion of the executive committee.

Section 2.‡ A person stricken from the list of members because of non-payment of dues, upon written application may be reinstated as a member in his former class without loss of privileges, either upon payment of all back dues (which must accompany applications) or at the discretion of the executive committee voting in the manner prescribed in Section 2, Article III.

ARTICLE VIII.*

LOCAL SECTIONS

Section 1.** Upon the application of ten or more members of the association residing in the same geographical district, or having offices therein, the executive committee shall organize a local section for that district, to which all members in that district shall be eligible. Such local section shall admit to active membership only members in good standing. It shall hold not less than two meetings each year, and shall be governed by such constitution and by-laws not inconsistent with the constitution of this association as the section membership may adopt and the executive committee approve.

Section 2. The parent association shall not be put under any obligation, either financial or in the matter of policy or opinion, by any local section.

ARTICLE IX.

AMENDMENTS

Section 1. This constitution may be amended at any regular meeting by a two-thirds vote of the members present, provided that notice of the proposed amendment or amendments has been sent to the members at least 30 days previous to said regular meeting.

By-Laws

TIME OF MEETING

1.** The regular meeting of this association shall convene annually during the month of September, the exact date to be fixed by the executive committee.

PLACE OF MEETING

2.** The place of holding the annual convention shall be Chicago, Ill.

3. It shall be within the power of the executive committee to change the location or time of the meeting if it becomes apparent that it is for the best interests of the association.

QUORUM

4. At the regular meeting of the association, 15 or more members shall constitute a quorum.

***DUES

5. The annual dues for the fiscal year ending August 31, and payable in advance, shall be as follows:°

Members, $20.00; Associate Members, $20.00.§

DUTIES OF OFFICERS

6.† The president shall have general supervision over the affairs of the association. He shall preside at all meetings of the association and of the executive committee; shall appoint all committees not otherwise provided for, and shall be ex-officio member of all committees. He shall with the secretary sign all contracts or other written obligations of the association which have been approved by the executive committee. He shall render a detailed report at least three times during the year to the members of the executive committee, showing the financial condition of the association and its activities.

At the annual meeting the president shall present a report containing a statement of the general conditions of the association.

7.‡‡ The Vice-Presidents in order of seniority shall preside at meetings in the absence of the President and discharge his duties in case of a vacancy in his office. The Senior Vice President shall have the senior position of Vice Presidents.

8.† It shall be the duty of the secretary to keep a correct record of the proceedings of all meetings of this association, and of all accounts, between this association and its members; to collect all moneys due the association, and deposit the same in the name of the association. He shall pay all bills when properly certified and approved by the president and the treasurer, and make such reports as may be called for by the executive committee. He shall also perform such other duties as the association may require.

9.‡ The treasurer shall have charge of the funds, check all deposits as made by the secretary, sign all checks after they have been approved by the president, and invest all funds not needed for current expenses as directed by the executive committee. He shall report at each annual meeting on the condition of the finances.

NOMINATING COMMITTEE

10.# After each annual meeting the president shall appoint a committee consisting of five members. Two Past Presidents shall be members of this committee, one of whom shall act as Chairman. No other officers of the Association shall be appointed to this committee. This committee shall prepare a list of names of nominees for officers to be voted on at the next annual convention in accordance with ARTICLE VI of the Constitution, said list to be read at the business session of said convention. Nothing in this section shall be construed to prevent any member making further nominations provided that such nominations are received by the President in writing not less than thirty (30) days in advance of the first day of the annual meeting. Such nominations should be addressed to the President of the Association at its headquarters office.

---

‡Adopted October 17, 1940.
#Amended March 23, 1983.
†Amended September 20, 1948.
‡Amended September 21, 1957.
‡‡Amended September 20, 1978.

AUDITING COMMITTEE

11.‡ Prior to each annual meeting the president shall appoint a committee of three members, not officers of the association, whose duty it shall be to examine the accounts and vouchers of the secretary and the treasurer and certify as to the correctness of their accounts.

COMMITTEE ON SUBJECTS FOR DISCUSSION

12. After each annual meeting the president shall appoint a committee whose duty it shall be to prepare a list of subjects for investigation to be submitted for approval at the next convention.

COMMITTEE ON INVESTIGATION

13. After the association has adopted the list of subjects for investigation the president for the succeeding year shall appoint the committees who shall prepare the subjects for report and discussion. He may also appoint individual members to prepare reports on special subjects, or to report on any special or particular subject.

PUBLICATION COMMITTEE

14. After each annual meeting the executive committee shall appoint a publication committee consisting of three active members whose duty it shall be to cooperate with the secretary in the issuing of the publications of the association. The assignment of this committee shall be such that at least one member shall have served on the committee during the previous year.

ORDERS OF BUSINESS

15.† Call to order by president.
Opening prayer or invocation.
President's address.
Report of secretary.
Report of treasurer.
Appointment of special committees.
Reports of standing committees and presentation of papers.
Unfinished business.
New business.
Election of officers.
Installation of officers.
Adjournment.

DECISIONS

16. The votes of a majority of the members present shall decide any questions, motion or resolution which shall be brought before the association, unless otherwise provided. Unless specifically provided herein otherwise, all discussions shall be governed by Robert's rules of order.

AMENDMENTS

17.† The By-Laws can be amended by a two-thirds vote of those present at any regularly called executive committee meeting.

---

†Amended September 20, 1948.
*Article adopted 1922.
**Amended September 20, 1948.
‡Amended September 21, 1957.
***Amended September 15, 1965.
§Amended June 8, 1984

ALPHABETICAL LIST OF ALL MEMBERS

M Indicates Member
A Indicates Associate Member
L Indicates Life Member
H Indicates Honorary Member

(Figures following name indicate year in which membership became effective)

A

Abbott, E.L. (A'69), Sales Engr.
General Railway Signal Co.
2120 Prudential Plaza, Chgo., IL 60601
Adams, D.A. (M'84), B&B Supv., MP
Coffeyville, KS 67337
Anderson, B. (M'82), Supv. Structures Conrail
Columbus, OH 43215
Anderson, D.A. (M'80), Supv. B&B, DM&IR
Proctor, MN 55810
Anderson, H.E. (A'74), Mgr. Opers.
Osmose Company — P.O. Box 8276
Madison, WI 53708
Anderson, T.C. (M'83), Des. & Constr. Mgr.
Schnabel Foundation
Cary, IL 60013
Anderzunas, P.P. (M'84), Asst. Div. Engr.
B&B, C&S, Conrail, Mt. Holly, NJ 08060
Andrews, D.J. (M'69), B&B Supv., C&NW
Menomonee Falls, WI 53051
Anthony, O.D. (M'71), Asst. Ch. Engr.
B&A — Bangor, ME 04401
Armenta, C.G. (M'82), Asst. Gen. Frmn. ATSF
Madera, CA 93637
Armstrong, W.F. (M'47, L'81, H'82), Ret.
Engr. Bldgs., C&NW
517 Spring Lake Blvd.
Brandenton, FL 33507
Arnold, L.K. (M'62, L'77), Ret.
Asst. Gen. Fore., B&B-WS, AT&SF
San Bernadino, CA 92407
Aylward, P.E. (M'76), Rdm., UP
Quincy, CA 95971

B

Bailey, J. (M'77), B&B Supv., ICG RR
Oak Forest, IL 60452
Baker, B.C. (M'82), Asst. Eng., B&A
Bangor, ME 04401
Baker, F.A. (M'55, L'70), Ret. Gen. Br. Insp., SP
2507 Polk St.
Eugene, OR 97405
Baker, R.C. (M'80), B&B Supv., EJ&E
Joliet, IL 60434
Banks, E.G. (M'83), Supv. Scales, SP
San Francisco, CA 94105
Barr, A.S. (M'66, L'81), Ret. — Ch. Reg. Eng., PC
1219 Firston Circle
Pittsburgh, PA 15241
Barrett, J.E. (A'71), Sr. VP
Alfred Benesch & Co.
233 N. Michigan Ave.
Chicago, IL 60601
Barrett, P.L. (M'82), Br. Designer, AT&SF
Chicago, IL 60632
Barry, W.J. (A'83), Director Field Services
Teleweld, Inc.
245 W. Roosevelt Rd.
West Chicago, IL 60185

B

Barsema, M. (M'58, L'75), Ret. B&B Supv., C&NW
28W732 Geneva Rd.
West Chicago, IL 60185
Bartley, C.W. (M'66, L'84), Ret. B&B Supv.
2833 Alpine View Dr.
Laurel, MI 59044
Bateman, J.D. (M'82), Bridge Inspector, MP RR
Arlington, TX 76018
Beattie, G.W. (M'82), Asst. Div. Engr., AT&SF
Pearland, TX 77588
Beaver, J.F. (M'50, L'65), Ret. Ch. Engr., Sou
P.O. Box 1548
Holmes Beach, FL 33509
Bechly, D.S. (M'68, L'85), Ret. Engr. Strs., ICG
233 N. Michigan Ave.
Chicago, IL 60601
Becker, R.J. (A'69), Vice Pres.
Lee Turzillo Contracting Co.
29100 Hall St.
Cleveland, OH 44139
Begnaud, R.A. (M'84), Str. Designer, Amtrak
Philadelphia, PA 19149
Beebe, L.C. (M'85), Safety Engr., M/W, UP
Cheyenne, WY 82001
Beirne, J.M. (M'76), Asst. Div. Engr., N&W
Moberly, MO 65270
Bell, D.V. (M'57, L'71), Ret. Gen. Str., Chessie
RR #1, Wellston, OH 45692
Benson, D.D. (M'72), Water Serv. Supv., UP
Salt Lake City, UT 84105
Beran, J.R. (M'83), Asst. Br. Engr., UP
Omaha, NE 68179
Beringer, M.A. (M'29, L'69), Ret. Supt. Br. Erec.
IC — 4013 Noble
Zachary, LA 70791
Bonner Springs, KS 66012
Berkel, C.J. (A'59), President
Berkel & Co. Contractors, Inc.
P.O. Box 335
Bonner Springs, KS 66012
Bertel, D.J. (M'68, L'83), Ret. Ch. Engr. Mtce.-MP
3032 Yucca Rd.
Willow Park, TX 76086
Besl, M.W. (A'76), Proj. Mgr.
Detzel Construction Co.
2160 Langdon Farm Rd.
Cincinnati, OH 45222
Bessey, D.A. (M'77), Sr. Architect
Envirodyne Engineers, Inc.
168 N. Clinton
Chicago, IL 60606
Bhalakia, M.P. (M'73), Des. & Const. Engr., P&LE
Pittsburgh, PA 15219
Bhardwaj, P.L. (M'75), Designer, C&NW
Chicago, IL 60606
Bibly, K.C. (M'67), Mgr. Power House, Amtrak
Chicago, IL 60606

A&K pioneers vendor-supplied continuous welded rail (CWR).

Photographs, permission of the Holland Company

© 1983 A&K

Now, A&K Railroad Materials, Inc., America's leading supplier of rail products, pioneers another first: Single-source, vendor-supplied continuous welded rail.

One call — one supplier.
Time was, it took dozens of calls, contracts, and many man hours of coordination and management to procure CWR. But now — a single phone call to A&K is all it takes. Because A&K can now provide complete CWR service. You specify the rail section and the location of the line; A&K does the rest.

A reputation for service.
A&K has built a reputation on fast service. For anything from a keg of spikes to a hundred miles of new rail, chances are A&K can fill your order well ahead of any other supplier. Even with CWR — your order is delivered and ready for installation within 60 days.

For CWR and all new rail needs.
Depend on the fully stocked, single-source supplier. Depend on A&K Railroad Materials, Inc.

Call or write Corporate Headquarters today

A & K Railroad Materials, Inc.
1505 South Redwood Road, Dept Q-5 • P O Box 30076 • Salt Lake City, Utah 84130
Phone (801) 974-5484 • Toll-Free (800) 453-8812 • Telex 389-406 A&K SLC

B

Bigelow, R.B. (M'82), Proj. Engr.
Cole Associates
Merrillville, IN 46410
Billings, J.D. (M'74), B&B Supv., C&NW
Chadron, NE 69337
Billmeyer, E.D. (M'55, L'69), Ret. Asst. to
Ch. Engr.-Struc., W.M.
9610 Orpin Rd.
Randallstown, MD 21133
Binkley, W.O. (M'79), Gen. Supv. Brs., Seaboard
Jacksonville, FL 32229
Bishop, D.B. (A'46, L'69), Ret. VP
Dearborn Chemical Co.
50 Ocean Drive
Punta Gorda, FL 33950
Blank, Simon (M'84), Field Engineer
Urban Engineers Inc.
86 Linda Avenue
Oakland, CA 94611
Boehling, H.A., Jr. (M'48, L'76), Ret. Gen. Supv.
Strs. — Chessie
1509 W. Laburnum Ave.
Richmond, VA 23227
Boileau, R.J. (M'85), Str. Engr., BN
Overland Park, KS 66201
Bolwahnn, L.O. (M'82), Architect, CMSP&P
Chicago, IL 60606
Bonas, D.J. (M'83), Asst. Engr., Southern
Atlanta, GA 30303
Bond, E. (M'66), Engineer Bridges, NW RR
Roanoke, VA 24042
Borg, M.T. (M'84), Reg. Supv., B&B, BN RR
Naperville, IL 60540
Born, J.O. (M'56, L'84), Ret. Ch. Engr., MC
398 Brook St.
Westbrook, ME 04092
Bowman, H.R. (M'84), B&B Supv., BN RR
N. Owasso, OK 74055
Boyd, J.E. (M'82), Dist. Engr., AT&SF
Amarillo, TX 79171
Bradfield, R.G. (M'57, L'73), Ret. Agree. Engr.
P.C. — P.O. Box 858
Trenton, FL 32693
Bradley, M.L. (M'82), Supv. Structures Conrail
Columbus, OH 43220
Brakensiek, W.E. (M'62), Asst. Ch. Engr. Strs., MP
St. Louis, MO 63103
Brashares, R.E. (M'69), Sys. Engr. Strs., Chessie
Huntington, WV 25718
Brietzke, W.F. (A'56, L'82), Ret. Gen. Mgr.
Pettibone Corp.
1150 Tarpon Center Dr.
Venice, FL 33595
Broglen, L.E. (M'71), B&B Supt., UP
N. Little Rock, AR 72114
Brookings, D.W. (M'77), Engr. Trk., KCS
Shreveport, LA 71107
Brooks, R.L., Jr. (M'80), Asst. Gen. Fore., B&B
ATSF — Ft. Worth, TX 76102
Brown, J.D., Jr. (M'72), Sr. Proj. Engr., Seaboard
Lexington, IN 47138
Brown, R.M. (M'67, L'84), Ret. Ch. Engr., UP
2032 S. 113th Ave.
Omaha, NE 68144
Brownlee, W.R. (M'78), B&Str. Mtce. Engr., CN
Winnipeg, Man., Canada

B

Bruestle, K.E. (M'83), Br. Engr., BN
Billings, MT 59101
Bryaliuk, D. (M'84), B&B Master, CP
Winnipeg, Man., Canada
Bryant, N.D. (M'61, L'85), Ret. Asst. Ch. Engr., BN
Overland Park, KS 66225
Buchanan, R.S. (M'84), Gen. B&B Supv., Southern
Phoenix City, AL 36867
Buchko, D.E. (M'75), Project Engineer, ICG
Chicago, IL 60601
Buckley, S.J., III (M'80), Asst. to Chf. Eng., BRS
Southern — Atlanta, GA 30303
Buckmaster, W.A. (M'51, L'69). Ret. Asst.
Div. Eng., B&OCT
510 S. Country Club Road
Tucson, AZ 85716
Budzileni, J. (M'63), Sr. Str. Designer, ICG
Chicago, IL 60601
Burch, E.E. (M'45, L'63), Ret. Br. Engr., CMSP&P
P.O. Box 303
Estill, S.C. 29918
Burleson, H.S. (M'69, L'78), Ret. Mgr. Mech.
Engr., DM&IR
8722 Arbor St.
Duluth, MN 55808
Burns, B.T. (M'78), Steel Br. Insp., AT&SF
Topeka, KS 66628
Burris, H.A. (M'72), Asst. Div. Engr., AT&SF
Barstow, CA 92311
Burrows, F.G.A. (M'73), Cons. Engr., Prof. of Eng.
California State University
Arcata, CA 95521
Burpee, C.M. (M'30, L'65), Ret. Editor
Wood Preserving News
1051 Mountain View St.
Hendersonville, N.C. 28739
Busch, K.L. (M'77), Associate
Horner & Shifren, Con. Engrs.
St. Louis, MO 63110
Byers, W.G. (M'69), Br. Engr., AT&SF
Amarillo, TX 79101

C

Caley, D.L. (M'81), B&B Supv., MP
Jefferson City, MO 65101
Calhoun, J.C. (M'77), B&B Supv., Southern
Knoxville, TN 37901
Callahan, J.R. (A'81), Secr.-Treas.
Donald J. Hogan & Co.
327 S. LaSalle
Chicago, IL 60604
Camelle, E.J. (M'54, L'77), Ret. B&B Supv., SP
Lafayette, LA 70501
Campbell, H.D. (A'61), Vice Pres. Mrktg.
Kershaw Mfg. Co., Inc., P.O. Box 17340
Montgomery, AL 36117-0340
Campbell, J.A. (M'83), Asst. Architect, Conrail
Philadelphia, PA 19104
Carlson, A.W. (M'55, L'78), Ret. Chf. Engr., WP
414 Alameda Des Las Pulgas
San Mateo, CA 94402
Carlson, N. (A'84), Dist. Mgr.
Fairmont Railway Motors
1260 Virginia Dr., Ft. Washington, PA
Carpenter, S.R. (M'83), B&B Supv., Sou RR
Church Hill, TN 37642

BERKEL & COMPANY

CONTRACTORS, INC.

MAINTENANCE OF RAILROAD SUBSTRUCTURES

with

Pressure Grouting
Underpinning

Pressure Grouted Piling
Preplaced Aggregate Concrete

(913) 422-5125
Kansas City Phone

2649 South 142nd street
P.O. Box 335
Bonner Springs, Kansas 66012

Total Restoration Contractors

Detzel offers a full range of restoration services from steel repairs and pile driving to gunite and epoxy injection to pressure grouting and tuckpointing to complete structural restoration regardless of any special rigging requirements. And, because they do offer a complete range of services, they can select the best methods for doing your job effectively and in the least amount of time.

One example of this capability is in their restoration of railroad bridges. Using fast curing polymer concrete they are able to keep bridge down-time to only hours, while eliminating the massive problems of rigging precast concrete or steel into repair position. And the short downtime keeps the trains on time.

GUNITING • TUCKPOINTING • EPOXY INJECTION • GROUTING • CAULKING • BRIDGE, BUILDING & PARKING RESTORATION

DETZEL CONSTRUCTION

2160 Langdon Farm Road, P.O. Box 37269
Cincinnati, OH 45222
Telephone 513-631-3100 *a division of* **The Fenton Rigging Co.**

C

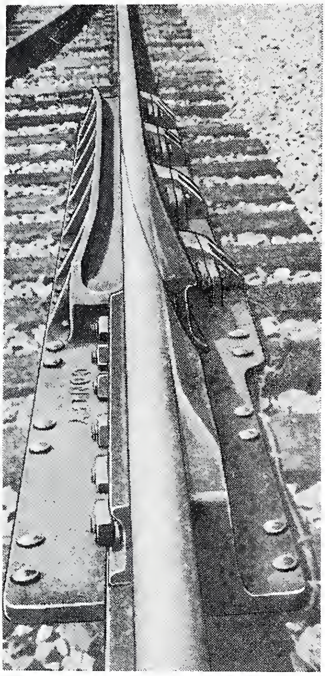
Carter, A.B. (M'77), Asst. B&B Supv., Seaboard
Brandon, FL 33511
Carter, J.W. (M'47, L'60), Ret. B&B Supv., N&W
1910 Maylin Dr.
Salen, VA 24153
Carter, R.W. (M'85), Asst. B&B Supv., BN
Billings, MT 59101
Carver, D.W. (M'81), Asst. Rdwy. Supv., BS
Wylam, AL 35224
Carver, H.H. (M'71), Supv. B&B, KCT
Kansas City, MO 64108
Cary, N.M. (M'53, L'83), Ret. Process Engr., Trk.
Southern, 533 Windgrove Rd.
Marietta, GA 30067
Castrucci, A. (M'82), Supv. Strs., Conrail
New Castle, PA 16101
Caywood, J.A. (A'59), Pres. & Gen. Mgr.
DeLeuw, Cather & Co.
1211 Conn. Ave. NW, Suite 602
Washington, D.C. 20036
Cecchi, D.G. (M'83), Str. Engr.
Collins Engineers, Inc.
Chicago, IL 60606
Celander, H.W. (M'59, L'73), Ret. Asst. Engr.
CMSP&P, 601 Berkshire Ct.
Schaumburg, IL 60172
Cerny, L.T. (M'80), Executive Dir., AREA-AAR
50 "F" St. NW, Suite 7702
Washington, D.C. 20001
Chamberlain, P.C. (M'41, L'71), Ret. Asst. to
Engr. Str., EL
26 Kathleen Pl., Morris Plains, NJ 07950
Chambers, J.W. (M'62, L'84). Ret. Br.
Const. Engr., MP
12200 Eddie & Park Rd.
St. Louis, MO 63127
Chambers, R.J. (M'83), Sys. B&B Supv., UP
Omaha, NE 68179
Chan, Wallace (M'85), Program Engineer, Conrail
Philadelphia, PA 19104
Charrow, A.M. (M'82), Asst. Div. Engr., AT&SF
Amarillo, TX 79171
Chiodo, G.S. (M'83), Asst. to Div. Engr., UP
Portland, OR 97227
Christensen, M.C. (M'63, L'82), Ret. Asst. Ch.
Eng. Str., C&NW
401 W. Crystal Ave.
Lombard, IL 60148
Christenson, T.J. (A'74), Vice Pres.,
Chris Construction Co.
Madison, WI 53716
Christiansen, G.W. (A'72), Chairman
Racine Railroad Products, Inc.
1524 Frederick
Racine, WI 53404
Clark, K.L. (M'82), Asst. Gen. Bridge Fore., AT&SF
Newton, KS 67114
Clark, T.H. (M'76), Gen. Supv. Str., Chessie
Huntington, WV 25705
Clark, W.H. (M'59, L'81), Ret. Ch. Eng. Cons.
ATSF, 1029 Matador Dr. SE
Alburquerque, NM 87123
Clary, A.G. (M'67), Engr. Mtce., Natl. Academy
of Science, Trans Research Bd.
Washington, D.C. 20418

C

Cochran, D.O. (M'82), B&B Supv., Southern
Wilton, AL 35187
Compton, G.R., Jr. (A'84), President
MKT Geotechnical Systems
Box 793, Dover, NJ 07801
Conklin, R.J. (M'82), B&B Supv., Conrail
Cleveland, OH 44113
Conlon, P.C.L. (M'81), Mgr. Envir. Studs. Div.
AAR — Washington, D.C. 20036
Conroy, R.P. (M'76), Asst. Engr. B&B — D&H
Watervliet, NY 12189
Cook, J.C., Jr. (M'59, L'82), Ret. Gen. Fore., B&B
WS, ATSF, 2510 Gila
Temple, TX 76501
Cooney, James E. (A'85), VP, Ketler Co.
Chicago, IL 60609
Constantino, A.A. (M'84), Staff Engr.-Projs., LI
Jamaica, NY 11435
Coventry, K.J. (M'66), Ch. Eng., AC
Sault Ste. Marie, Ont., Canada
Crawford, J.D. (M'82), Asst. Gen. Fore., AT&SF
Barstow, CA 92311
Crespo, MJ. (A'56), Engr. Spec. Trans.
Bechtel Corporation
17438 Via Corona
San Lorenzo, CA 94580
Crisp, J.C. (M'83), B&B Supv., UP
Evans, CO 80620
Crosby, R.C. (A'61), Vice Pres.
Railway Products Co., P.O. Box 1511
Knoxville, TN 37901
Crutchfield, W.T. (M'82), Gen. Fore., ATSF
Ft. Madison, IA 52726
Cummings, L. (M'69, L'84), Ret. Gen. Br. Insp., SP
6806 Scoter Way
Sacramento, CA 95842
Cummins, C.P. (A'48, L'73), Br. Engr.
St. Louis Division of Highways
7934 Stanford Ave., University City, MO 63130
Cunningham, W.P. (M'81), Util. Engr., MP
St. Louis, MO 63103
Cushman, D.G. (M'79), B&B Supv., MP
Salem, IL 62881

D

Dahlin, W.G. (M'84), Supvr., B&B, BN
Billings, MT 59101
Darnell, K.E. (M'83), Vice Pres.
Geologic Associates, Inc.
Knoxville, TN 37922
Davids, G.A. (M'73), Trk. Safety Insp., FRA
Linthicum, MD 21090
Davidson, J.W. (M'57), Asst. Ch. Engr.
Des. & Strs., BN
Overland Park, KS 66210
Davis, D.R. (M'73), Gen. Supt, A&SAB
Panama City, FL 36401
Davis, H.E. (M'40, L'66), Ret. B&B Supv., NYC
Arlington Heights, IL 60004
Davis, J.W. (A'82), Ch. Exec. Officer
Kershaw Manufacturing Co., Inc.
P.O. Box 17340, Montgomery, AL 36117
Davis, R.R. (M'82), Sr. B&B Supv., CMSP&P
Elgin, IL 60120



Meet the sliding rail

. . . that will prevent buckling, pull-aparts, and other problems caused by rail expansion and contraction!

In addition, each Conley Sliding Rail is designed to meet *specific* track conditions. Each is completely automatic and temperature-controlled. And its heavy base (approx. 2400 lbs.) assures solid foundation and rugged, long-lasting dependability.

The heat-treated, pre-curved wing rail, and one-piece manganese steel casting—consisting of base, point, guard rail, and rail braces — insures a constant guage. (Photo indicates the heavy wheel tread that is maintained regardless of rail expansion or contraction.)

Conley

For complete details write:

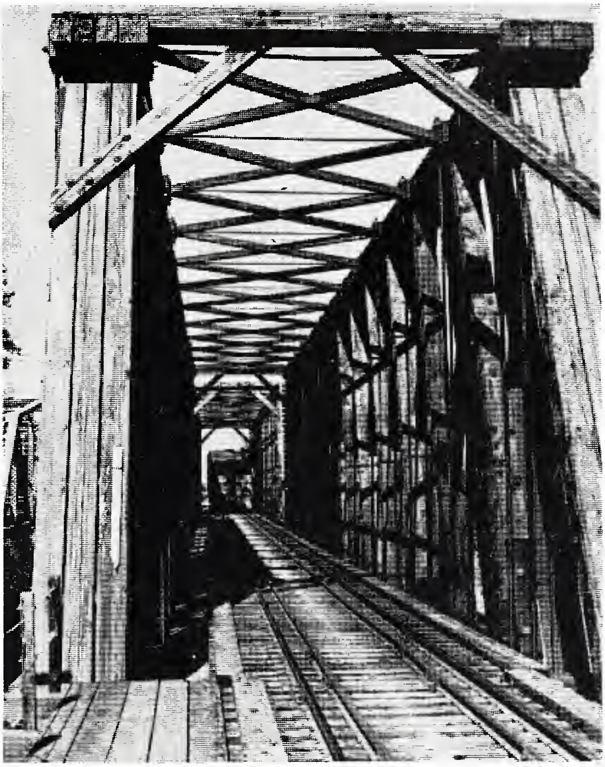
Conley Frog and Switch Co.
Box 9188 / Memphis, Tennessee 38109

D

Dawson, E.J. (M'85), Reg. B&B Supv. BN
Springfield, MO 65802
Day, F.D. (M'49), Sys. Eng. Str. Mtce., Conrail
Philadelphia, PA 19104
Deady, P.F. (M'84), Vice Pres. (Engr. & Mech.)
Maint., ICG, Chicago, IL 60601
DeBerg, D.G. (M'82), Consultant
5108 SW Shunga Dr.
Topeka, KS 66614
Dennewald, R. (M'84), Civil Engr., Trade ARBED
New York, NY 10022
Dennis, W.B. (A'84), B&B Carpenter, MP
Anita, IA 50020
Denz, O.C. (M'67, L'83), Ret. Supv. Bld. Maint.
CMSP&P — 2247 Farnsworth
Northbrook, IL 60062
DeRosier, N.S. (M'76), Asst. B&B Mast., CP
Revelstoke, B.C., Canada
Deterding, D.L. (M'85), Asst. Brdg. Engr., UP
Omaha, NE 68179
DeValle, J.W. (M'59, L'79, H'82), Ret. Ch. Engr.
Bridges, Southern — 629 Brookline Dr.
Marietta, GA 30067
Dick, M.H. (M'37, H'68), Ret. VP Editor
Railway Track & Structures
369 Des Plaines Ave.
Riverside, IL 60546
Dick, S.M. (M'83), Br. Designer, ATSF
Chicago, IL 60632
Diehl, C.M. (M'59, L'84), Ret. Reg. Engr. Str.
& Piers, Chessie
Baltimore, MD 21201
Diersen, L.M. (M'73), Dir. Engr. Servs., B&LE
Monroeville, PA 15146
Dimitrief, A. (A'77), Str. Div.
Clark Dietz Engineers — 211 N. Race St.
Urbana, IL 61801
Dixon, C.E. (M'55, L'74), Ret. B&B Supv., MC
298 Fern St, Bangor, ME 04401
Dobranetski, E.B. (M'70), Engr. Facilities &
Structures, B&LE
Monroeville, PA 15146
Doherty, G.D. (M'70), Div. Supv. B&B, CMSP&P
Schaumburg, IL 60193
Dolan, D. (A'84), Asst. Area Mgr.
Osmose Railroad Division
1414 Heather, Kearney, MO 64060
Dolby, A.J. (M'75), Pres., Dolby & Assocs. Inc.
Philadelphia, PA 19106
Donegal, A.O. (M'79), Asst. Engr. Trk., LI
Jamaica, NY 11435
Doss, P.R. (M'84), B&B Supv., Southern
Asheville, NC 28803
Dout, K.R. (M'82), Asst. Gen. Fore. B&B, AT&SF
Temple, TX 76502
Dove, R.E. (M'34, L'76, H'65), Ret. Assoc. Ed.
Ry. Trk. & Struc. — 175 Geneva Ave.
Elmhurst, IL 60126
Draper, B.L. (M'83), Div. Engr., ATSF
Newton, KS 67114
Dreiling, R.G. (M'84), Str. Design, MP
St. Louis, MO 63103
Dresden, A.S. (A'77)
1102 Sprucewood
Mt. Prospect, IL 60056
Drier, D.C. (M'83), Proj. Mgr., ICG
Chicago, IL 60601
Driscoll, D.J. (M'80), Reg. Supv., B&B, BN
Seattle, WA 98104
Drone, W.J. (A'81), President
Transportation Products Co.
332 S. Michigan Ave., #1763
Chicago, IL 60604
DuBois, G.W. (M'82), Div. Engr., Amtrak
Chicago, IL 60606
Duchac, J.V. (M'27, L'60), Ret. Supv. B&B, C&NW
716 Badger Ave., Antigo, WI 54409
Duncan, F. (M'62, L'82), Ret. Rdm., WSS
1297 E. Cannan Ave., Albemarle, NC 28001
Dunn, R.H. (A'68), President
R.H. Dunn & Associates, Inc.
2840 Rifle Ridge Rd., Oakton, VA 22124
Dunn, T.V. (M'82), Proj. Engr., C&NW
Torrington, WY 82240
Dunsworth, J.E. (M'83), B&B Supt., MP
Kansas City, MO 64120
Duquaine, D.J. (M'68), B&B Supv., CMSP&P
Miles City, MT 59301
Durrant, H.B. (M'68, L'85), Ret. Asst. Ch. Engr., UP
Omaha, NE 68124
Dwinnell, W.B. (M'83), Ch. Engr., LI
Jamaica, NY 11435
Dziak, J.E. (M'80), Proj. Mgr., IHB
Hammond, IN 46325

E

Eargle, J.M. (M'53, L'71), Ret. Mast. Carp., SCL
121 Wanda Lane, Austell, GA 30001
Edwards, G. (M'75), Gen. B&B Supv., UP
Omaha, NE 68127
Edwards, J.W. (M'66), B&B Supv., Southern
Columbus, GA 31902
Eich, K.W. (M'75), Clear Engr., CNW
Chicago, IL 60606
Eichenlaub, C.M. (M'43, L'60), Ret. Supt., SD&AE
3665 Keating St., San Diego, CA 92110
Elizondo, A. (M'84), B&B Inspector, MP
Ft. Worth, TX 76107
Elliott, C.E. (M'50, L'67), Eng. MW&S, WP
5204 Cribari Hills, San Jose, CA 95135
Elliott, W.H., Jr., (M'85), Brdg. Inspector, MP RR
Spring, TX 77383
Ellison, J. (M'79), B&B Foreman, Southern
Jemison, AL 35085
Eoff, T.E. (M'68), Assoc. Str. Engr., BN
Springfield, MO 65807
Epperson, E.D. (M'72), Asst. Supv. B&B, BN
Willard, MO 65781
Erickson, N. (M'79), Sr. Str. Engr.
Capitol Engineering Corp.
Dillsburg, PA 17019
Erskine, J.A. (M'59, L'77), Ret. Str. Eng., ICG
1663 Hunter Ave.
Mobile, AL 36604
Eschenbach, J.P. (M'83), Res. Engr., Amtrak
Baltimore, MD 21201
Evans, R. (A'59), Armco, Inc.
P.O. Box 41307
Chicago, IL 60641
Evans, T.E. (M'72), Supv. Safety Spec., FRA
West Chester, PA 19382
Everitt, S.J. (M'74), Term B&B Fore., ON
North Bay, ON



Railroad Bridge BN-18

...47 years of hard use without maintenance

The secret of its long, virtually trouble-free life: Pressure-creosoted wood.

Talk about being good for the long haul. This main line bridge, built by the Chicago, Milwaukee & St. Paul Railroad in 1933 is still going strong, today. Records disclose that routine tightening of tension rods to sustain desired camber, had been the sole necessary maintenance. This despite the fact that the bridge is located over the Nooksack River in Everson, Washington, just south of the Canadian border—and thus subject to severe weather conditions.

BN-18 is one of the nation's few remaining bridges of its type, incorporating a pair of Howe timber trusses, each 161 feet long. The overall length of the span, with approaches, is 395 feet. When originally assembled the only portion of the bridge that wasn't constructed of pressure-creosoted wood was the post bracing system. That was replaced in the 1950's with pressure-creosoted materials.

Durable, maintenance-free bridges like BN-18 are an asset to any railroad . . . they repay the initial investment many times over. That's why we call our pressure-creosoted wood the DIVIDEND brand—because it's low in first cost and continues to pay service life dividends . . . year after year.

Keep your maintenance costs down by specifying DIVIDEND timbers, support members, piling, crossties and right-of-way fencing, too.

Want to know more? *Write:*

The DIVIDEND Information Center
Dept. 19, 701 Investment Building, Pittsburgh, PA 15222
Phone: (412) 261-3158

DIVIDEND

PRESSURE-CREOSOTED WOOD

T11-8029R

F

Fairchild, E.H. (M'58, L'82), Ret. Asst. Engr., UP
1107 Reid Ave., North Platte, NE 69101
Fatula, P. (M'80), Prog. Engr.-Trk., Conrail
Philadelphia, PA 19104
Fetterman, Paul (M'85), Ch. Engr., P&W RR
Woonsocket, RI 02857
Fleres, A.M. (M'85), Asst. Engr.-Structures
Metro-North, New York, NY 10017
Flinn, L.E. (A'49), Sales Rep.
Western-Cullen-Hayes Inc.
2700 W. 36th Pl., Chicago, IL 60632
Folk, J.W. (A'76), President
Piedmont Railway Supplies, Inc.
620 Holcomb Bridge Rd.
Roswell, GA 30075
Foraker, J.W. (A'83), Reg. Mgr. — Ind. Sales
Burke-Parsons-Bowlby Corp.
P.O. Box 627, Spencer, WV 25276
Ford. L.G. (M'74), Constr. Engr., BN
Denver, CO 80217
Ford, P.V. (M'81), Structural Designer, ICG
Chicago, IL 60601
Foreman, J.E., Jr. (M'57, L'82), Ret. Dir. Engr.
Servs., B&LE — 522 Reynolds Rd.
Greenville, PA 16125
Forseth, C.E. (M'50, L'64). Ret. Div. Engr., WP
1116 Oakmont Drive — #6
Walnut Creek, CA 95495
Fort, O.E. (M'57, L'71), Ret. Ch. Engr., BN
854 S. Revolta Cade Dr., Mesa, AZ 85208
Fraise, J.D. (M'77), Asst. Gen. Fore., B&B, AT&SF
Ft. Madison, IA 52627
Frame, R.E., (M'65), Ch. Engr. Offcr., Seaboard
Jacksonville, FL 32202
Franz, D.K. (M'77). Br. Insp., CMSP&P
Chicago, IL 60606
Franzen, E.T. (M'57, L'82), Ret. Ch. Engr. Des. &
Constr., MP — 83 Webster Woods
Webster Groves, MO 63119
Fraser, R.A. (M'75), Stds. & Spec. Offr., CN
Montreal, Quebec, Canada
Frederick, E.R. (M'65), Engr. B&B, FEC
St. Augustine, FL 32084
Frederick, G.R. (M'67), Supt. Prod., CN
Winnipeg, Man, Canada
Frickenstein, B. (M'80), Asst. B&B Supv., C&NW
Clinton, IA 52732
Fronczak, R.E., (M'81)
4042-2N, Chicago, IL 60613
Frost, J.S.C. (M'82), Engr. Br. & Strs., BC
N. Vancouver, BC, Canada
Fuller, T.L. (A'59), Retired
11407 Charred Oak Drive, Austin, TX 78759

G

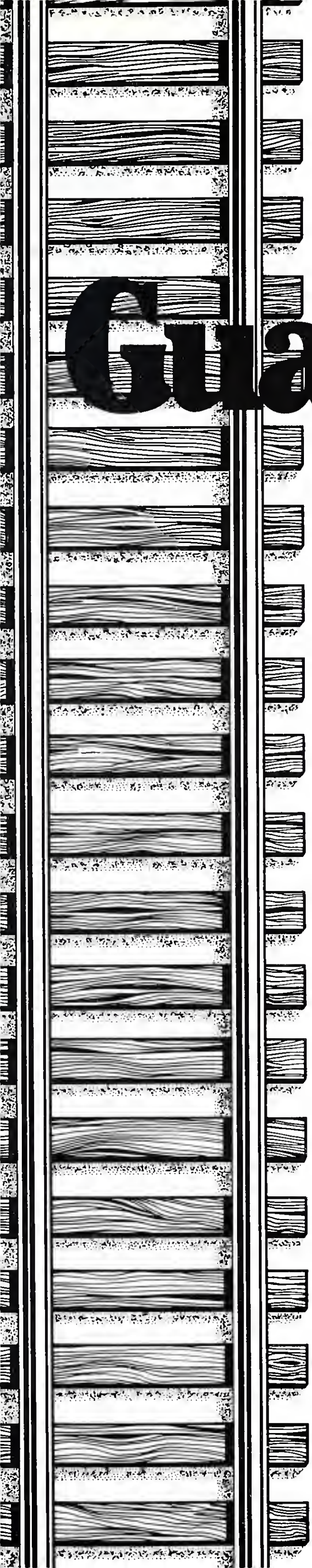
Gableman, P.D. (M'66), Mgr. Env. Engr., DM&I
Duluth, MN 55802
Gallop, C.M. (A'74), Manager, Kershaw Mfg.
Canada Ltd. — 407 Turrene St.
Winnipeg, Man, Canada
Gardner, W.E. (M'67), Supv. Steel Brs., MKT
Denison, TX 75020
Gaynor, W. (A'80). Vice Pres., F.K. Ketler, Co.
438 W. 43rd St., Chicago, IL 60609
German, J.G. (M'67, L'83). Ret. VP Engr., MP
1766 Lynkirk Lane, Kirkwood, MO 63122

G

Gibbs, R.R. (M'78), Gen. Fore., B&B, WS, ATS
Chicago, IL
Gilbertsen, H. (M'83), Consultant
Longwood, FL 32779
Gilley, C.E. (M'77), Asst. Ch. Engr. Strs., ATSF
Chicago, IL 60632
Gipson, C.G. (M'57, L'77), Ret. Gen. Fore. B&B
WS, AT&SF — 3955 W. Cactus Wren Dr.
Phoenix, AZ 85021
Goewey, C.T. (M'84), Engr. Bridges, N&W
Roanoke, VA 24042
Goforth, J.A. (M'54, L'81), Ret. Chf. Engr.
Erwin, TN 37650
Goldberg, D.A. (A'74), Vice President
Goodkind & O'Dea Inc.
1366 Clifton, Clifton, NJ 07012
Golem, G.G. (M'64, L'83), Ret. Asst. Engr.
Br. Dept., ICG
715 Vinewood, Willow Springs, IL 60480
Goodman, C.L. (M'80), Plant Supt., Chessie
Martinsburg, WV 25401
Goray, J.V. (A'67), Ch. Engr.
Joseph J. Graciano Corp.
7925 Hill Ave., Pittsburgh, PA 15221
Gosney, D.M. (M'84), Asst. Gen. Foreman, ATSF
San Bernadino, CA 92410
Gould, D.C. (M'67, L'83), Ret. Asst. Str. Engr., UP
2123 S. 109th St, Omaha, NE 68144
Gould, J.H. (M'83), Sr. Geotech Engr.
Rust International Corp.
Birmingham, AL 35201
Grant, G.H. (M'78), Gen. B&B Supv., UP
Nampa, ID 83651
Gray, J.L. (M'83), Sys. B&B Supv., UP
Omaha, NE 68179
Grecco, E.F. (M'69), Proj. Mgr., B&LE
Monroeville, PA 15146
Green, H.W., Jr. (M'82), Asst. Dv. Eng., ATSF
Richmond, CA 94801
Green, R.W. (M'83), Dist. Engr., AT&SF
Topeka, KS 66604
Griffin, L.B. (M'81), B&B Supv., BC
No. Vancouver, BC, Canada
Groh, C.W. (M'83), Division Engr., ATSF RR
Los Angeles, CA 90040
Grotz, W.A., Jr. (M'84), Dir. Engineering, AREA-AAR
Washington, D.C. 20001
Groves, G.R. (M'71), Div. Engr., MP RR
Longview, TX 73604
Gunderson, R.R. (M'47, H'69), Ret. AVP-WM
689 W. Lake Howard Dr., #107
Winter Haven, FL 33880
Gunkle, W.J. (M'66), Sr. Str. Insp., Conrail
Philadelphia, PA 19104
Gustafson, J.A. (M'69), Bridge Engineer, BN RR
St. Paul, MN 55164

H

Hague, C.H. (M'74), Con. Engr.
Alfred Benesch & Co.
Chicago, IL 60601
Hahn, H.D. (M'80), Br. Engr., C&NW
Chicago, IL 60606



Vegetation Management Guaranteed

New Du Pont VMS. Delivers performance to your standards.

Du Pont Vegetation Management Service (VMS) is the new, single-source solution to controlling weeds and brush on your railroad. It's a customized solution, designed to your specifications and standards of performance. And best of all, it's guaranteed.

As a VMS client, you'll have your own Du Pont account manager. His job is to develop cost-effective, long-term control of vegetation—to the specific needs of your system.

You'll benefit from the use of quality products from Du Pont and other manufacturers, our experience in the herbicide field and our mutual concern for safety standards.

Du Pont VMS. The unique, single-source solution to railroad vegetation management. Delivers performance to your standards. That's guaranteed.

To learn more, write us on your company letterhead. The Du Pont Company, Terry McDaniel,
VMS Manager, WM2-276,
Wilmington, DE 19898, or call
302-992-6146.

DU PONT
REG U S PAT OFF

H

Haines, W.W. (M'67, L'84), Ret. B&B Supv., UP
13910 S.E. Schiller, Portland, OR 97236
Hale, R. (M'77), Architect, AT&SF
Los Angeles, CA 90014
Hamilton, W.A. (M'65), Bridge Engineer, ATSF RR
Topeka, KS 66628
Hanes, R.M. (M'82), Asst. B&B Gen. Frmn., ATSF
Newton, KS 67114
Hanges, J.P. (M'79), Rdm., B&B Supv., C&NW
Iron Mountain, MI 49801
Hansen, D.G. (A'62), VP Sales
Lewis Bolt & Nut Co.
504 Malcolm Ave. S.E.
Minneapolis, MN 55414
Hartselle, R.A. (M'69), Constr. Engr., MP
St. Louis, MO 63103
Harvey, D.E. (M'82), Asst. Gen. B&B Frmn., ATSF
Augusta, KS 67010
Haug, G.E. (M'83), Br. Engr., BN
Seattle, WA 98104
Hauschildt, K.G. (M'85), Asst. Eng. Br. Dept.
Southern, Atlanta, GA 30303
Haven, P. (M'82), Asst. Engr. Brs., ATSF
Chicago, IL 60632
Hawley, I.H. (M'57, L'74), Ret. Ch. Engr., C&IM
40 Frairs Lane, Springfield, IL 62704
Heavin, J.W. (M'51), Dist. Engr., MP
Kansas City, MO 64120
Hedley, W.J. (M'50, L'68), AVP, N&W
825 Biltmore Drive
Clayton, MO 63105
Heinrich, T.C. (M'85), Str. Designer, NW
Roanoke, VA 24042-0052
Hellweg, R.D. (M'47, L'77), Ret. Reg. Engr.
Amtrak, 1301 N. Eastholme
Bloomington, IL 61701
Helm, J.M. (M'72), Drainage Engr., ICG
Chicago, IL 60601
Hemingway, W.J. (M'82), Engineer
Gene Sitter Corp., Gary, IN 46404
Hendrickson, L.D. (M'84), B&B Supv., BN
Minneapolis, MN 55421
Herren, G.H. (M'76), Gen. Fore. B&B, WS-AT&SF
Fresno, CA 93718
Hille, M.A. (M'83), Gen. B&B Supv., Southern
Hixson, TN 37343
Hoadley, D.E. (M'74), Prin. Engr. Staff, D&H
Watervliet, NY 12189
Hobbs, J.C. (M'58), Ch. Engr., RF&P
Richmond, VA 23230
Hodgkins, E.W. (M'58, L'79), Ret. Exec. Dir., AREA
238 Marquette, Park Forest, IL 60466
Hogel, E.C. (M'58, L'74), Ret. B&B Supv., UP
2600 West "E" St., North Platte, NE 69101
Hollander, Dennis (M'85), Operating Sgt., USAC
Milwaukee, WI 53207
Hool, D.K. (M'81), Proj. Engr., Conrail
Indianapolis, IN 46250
Hoppell, V.E. (M'67), B&B Supv., UP
North Platte, NE 69101
Horne, D.E. (A'65), Pres., Habco, Inc.
1418 5th St. S., Hopkins, MN 55343
Horney, J.J. (M'79), Sys. B&B Supv., UP
Omaha, NE 68179
Hornig, F.F. (M'47, L'71), Ret. Div. Engr.
CMStP&P, 1913 S.W. 2nd Ave.
Austin, MN 55912

H

Howard, J.G. (M'53, L'77), Ret. Gen. B&B Supv.
WP, Sacramento, CA 95816
Howe, A.K. (A'62, L'80), Ret. Civil Engr.
Ford, Bacon & Davis Construction Co.
3159 Cheryl Dr., Hendersonville, NC 28739
Hubbard, M.H. (M'48, L'64), Ret. Asst. Ch. Engr.
Sys., Chessie, 6 Calycanthus Lane
Richmond, VA 23221
Huffman, W.H. (M'41, L'73, H'78), AVP & CE
C&NW, 42115 Village 42
Camarillo, CA 93010
Hughes, C.A. (M'65), Civil Engr.
Santa Clara, CA 95051
Humphreys, R.W. (M'47, L'74), Ret. Dir. Cont.
Admin., BN, 812 Alderson
Billings, MT 59102
Humphries, A. (M'85), Brdg. Supv., UP Systems
Longview, TX 75602
Hunt, H.W. (A'72), Ch. Engr.
Associated Pile and Fitting Corp.
262 Rutherford Blvd., Clifton, NJ 07014
Hunter, A.L. (M'60, L'74), Ret. Supv. Str., B&LE
8 Park Ave., Greenville, PA 16125
Husbands, G.E. (M'82), Asst. Engr., Br. Ratings
ATSF, Chicago, IL 60632
Hutcheson, T.B. (M'61, L'78), Ret. AVP-CE-SCL
1825 Elizabeth Pl., Jacksonville, FL 32205
Hutcheson, W.A. (M'39, L'63), Ret. Supv.
Wk. Equip., Chessie, 310 W. Meadowview Rd.
Greensboro, NC 27407
Hutto, J.E. (M'51, L'76), Ret. Gen. Br. Ins., SCL
Hilton Head, GA 29928
Hutton, J.R. (M'68, L'83), Ret. Reg. B&B &
Utility Mgr., SLSW, 8006 W. 61st St.
Merriam, KS 66202
Hyma, W.R. (M'69, L'82), Ret. Br. Engr. Sys.
AT&SF, 818 Braemar Rd.
Flossmoor, IL 60422

I

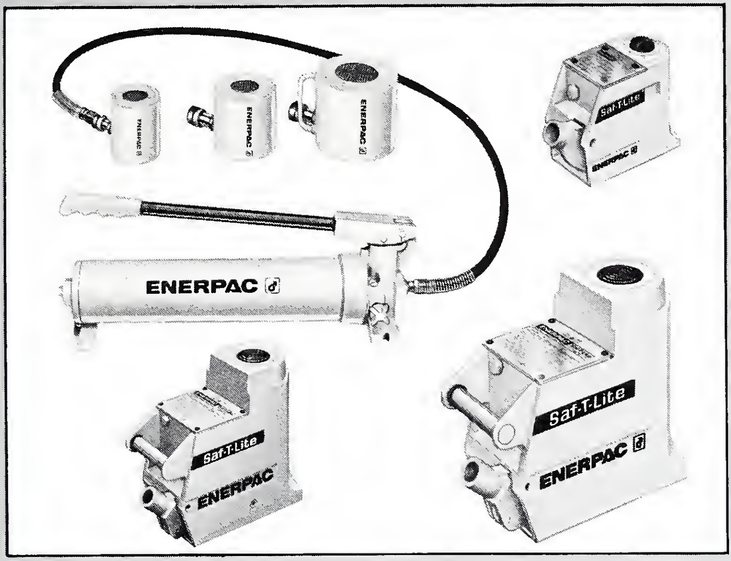
Iler, F.C. (M'65, L'83), Ret. Gen. Fore. B&B, W.S.
ATSF, Winslow, AZ 86047
Irby, C.W. (M'70), Gen. Fore. B&W-WS-AT&SF
Amarillo, TX 79109
Iwinski, J.R. (M'65), ACE Strs., C&NW
Chicago, IL 60606

J

Jaatteenmaki, E.T. (M'75), Engr. Tech. Spec., CP
Revelstoke, BC, Canada
Jackman, C.E. (M'58), Trans. Consultant
Baltimore, MD 21228
Jackson, T.E. (M'40, L'63), Ret. Gen. B&B Supv.
SP, 109 Karen Drive
Benicia, CA 94510
Jacobs, T.F. (M'62), Cons. Engr., GTW
Dearborn, MI 48124
Janosko, G.R. (M'83), Asst. Vice Pres., M/W & Str.
N&W, Roanoke, VA 24042
Jenkins, H.W. (M'40, L'69), Ret. Ch. Eng.
NY, NH&H, P.O. Box 447
Green Valley, AZ 85614
Jensen, A.H. (M'83), Water Serv. Supv., UP
Cheyenne, WY 82001
Jensen, P.K. (M'83), Asst. B&B Supv., CNW
St. Paul, MN 55101

MAINTENANCE

PORTABLE HYDRAULIC POWER



PUMP AND CYLINDER SETS . . . low height, lightweight and portable. Ideal for maintenance anywhere . . . excellent in tight areas. Sets range from 10 to100 Tons with strokes from 1½" to 2 7⁄16". Single or two speed Hydraulic Hand Pumps with hose permit operation at the application or up to six feet away.

HYDRAULIC JACKS . . . lightweight and rugged. All-Directional in 7, 15 and 35 Ton models. 75 and 150 Ton models are Two-Directional. Strokes from 3" to 6⅛". Jacking heights to 19".

See your local ENERPAC distributor for the complete Hydraulic Tool Catalog. Or, write ENERPAC, Butler, WI 53007.

ENERPAC®

J

Jess, G. (M'68), Fld. Engr. Str. Mtce., Conrail
Philadelphia, PA 19104
Johnson, A.C. (M'44, L'70), Ret. Eng. B&B, EJ&E
500 Ann Ct., Joliet, IL 60435
Johnson, A.E. (M'75), Fld. Eng., Des. & Con., GTW
Royal Oak, MI 48067
Johnson, A.K. (A'75), Sales Mgr., Detzel Const.
Div. of Fenton Rigging
2160 Langdon Farm Rd.
Cincinnati, OH 45222
Johnson, A.R. (M'76), Engr., C&IM
Springfield, IL 62705
Johnson, B.B. (M'75), Asst. Gen. B&B Fore.
AT&SF, Fort Worth, TX 76102
Johnson, E.A. (M'53, L'68), Ret. Engr. Br., IC
17720 Dixie Highway, Homewood, IL 60430
Johnson, H.T. (M'60, L'75), Ret. Supv. Matl. and
Equip. Engr., PC, 52 Helena St.
E. Brunswick, NJ 08816
Ft. Worth, TX 76101
Johnson, J.M. (M'82), Div. Engr., AT&SF
Temple, TX 76501
Johnson, M.L. (M'84), Reg. Supv. Bridges, BN
Billings, MT 59101
Johnson, W.E. (M'69), Gen. Fore. B&B-WS, ATSF
Temple, TX 76501
Jones, W.J. (M'62, L'77), Ret. Ch. Engr., SP
1000 Chestnut St., Apt 6-A
San Francisco, CA 94109
Jordan, C.D. (M'79), Reg. Supv. B&B, BN
Springfield, MO 65802
Jordan, S.L. (M'68), Staff Engr., MC
Portland, ME 04104
Jorlett, J.A. (M'40, H'66), Ret. Struc. Engr., PC
3 West Bergen Ave., Harvey Cedars, NJ 08008
Julius, H.R. (M'63, L'82), Ret. B&B Supv., ICG
642 Sherman Ave., Waterloo, IA 50703
Jurzak, T.A. (M'83), Estimator Br. Dept., CNW
Chicago, IL 60606

K

Kapp, J.T. (M'79), Proj. Mgr. Constr., Des. & Con.
Conrail, Philadelphia, PA 19104
Kappel, F. (M'80), Supt. Const. Project Mgmt.
Conrail, New Hope, PA 18938
Karasay, T. (M'84), Asst. Div. Engr. Strs., Amtrak
New Haven, CT 06511
Karsten, R.C. (M'78), Env. & Mech. Supv., SP
San Antonio, TX 78233
Katcher, G.W. (M'82), Reg. Supv. B&S, CN
Winnipeg, Man., Canada
Keller, J.C. (M'79), Br. Insp., Conrail
Albion, PA 16401
Kendall, J.T. (M'49, L'69), Ret. Supv. Str., PC
312 Cypress St., Montoursville, PA 17754
Kenyon, R.S. (M'85), Asst. Dir. Safety, M/W, UP
Omaha, NE 68179
Kerr, K.S. (M'85), Safety Engr. M/W, UP
Salt Lake City, UT 84101
Kershner, D.L. (M'81), Gen. Foreman, WT
Washington, D.C. 20002
Kessler, E.E. (M'82), Coord. Dim Loads and
Clearances, MP, St. Louis, MO 63103
King, B.J. (M'66), Bridge Engineer, C.L., ATSF RR
Los Angeles, CA 90040
King, L.E. (M'66), Reg. BB&U Mgr., SP
Rocklin, CA 95677

K

Kingrey, R.H. (M'83), B&B Supv., Southern
Slidell, LA 70458
Kleywegt, H.S. (M'84), Act. B&B Mast., BC
Prince George, B.C., Canada
Klosk, M.J. (A'85), President
Railroad Maintenance Corp., 432 Zerega Ave.
Bronx, NY 10473
Knuth, D. (M'75), Structural Engineer
CRS Sirrine Engineers
8700 Bryn Mawr
Chicago, IL 60631
Knuth, G.A. (M'78), Mgr. Structures, C&NW
St. Paul, MN 55101
Kontonis, P. (M'85), Civ. Engr. M.Sc.
Panos Kontonis Ltd.
Athens, Greece
Krakar, A.M. (M'84), Supv. Rd. Cross. Ren. Proj.
EJ&E, Joliet, IL 60434
Krause, R.D. (M'85), B&B Supv., BN
Billings, MT 59101
Krupa, G.E. (M'74), Mgr. Strctrl. Group
Delon, Hampton & Assoc.
222 W. Adams, Chicago, IL 60606
Kuhn, R.C. (M'81), Sys. B&B Supv., UP
Omaha, NE 68179
Kuhn, T.E. (M'77), Br. Constr. Eng., MP
St. Louis, MO 63103
Kulick, K.L. (M'80), Division Engr., Amtrak
Washington, D.C. 20002
Kuston, L.A. (M'75), Chf. Draftsman, C&NW
Chicago, IL 60606
Kvenberg, S.E. (M'32, L'62), Ret. Supv. Build.
Maint., CMSP&P, 1402 January Ct.
Woodbridge, VA 22193
Kwong, H.G. (M'76), Asst. Engr., AT&SF
Los Angeles, CA 90014

L

LaBeau, J.A. (M'69), Sr. Proj. Engr., EJ&E
Joliet, IL 60434
Ladner, D.R. (M'77), Asst. Engr., CNW
Boone, IA 50036
Lager, T.J. (M'78), B&B Supv., C&NW
Boone, IA 50036
Lake, G.D. (M'82), Div. Engr., AT&SF
Fresno, CA 93710
Lamkin, J.R. (M'85), Proj. Mgr., Southern
Marietta, GA 30066
Lancaster, J.E. (M'73), Supvr. B&B, B&M
Greenfield, MA 01301
Langevin, R.J. (M'70, L'82), Ret. Supv. Trk. Mtls.
CN, 93 Hansford Rd.
Winnipeg, Man., Canada
Langham, L.D. (M'64, L'84), Ret. Div. Engr., ATSF
Rt. 1, Box 110-A, DeKalb, TX 75559
Lantz, R.L. (A'75), Reg. Mgr. RR Sales
Koppers Co., Inc., 20 N. Wacker Dr.
Chicago, IL 60606
LaRose, A.E. (M'83), B&B Supv., MP
Corpus Christi, TX 78403
Lasley, D.E. (M'83), Asst. Br. Engr., KCS
Kansas City, MO 64105
Laughlin, B.B. (M'82), Div. Engr., AT&SF
Emporia, KS 66801
Laurick, M.J. (M'52, L'81), Ret. Proj. Engr., CR
1693 Sandalwood Pl.
Columbus, OH 43229

Look at our track record, and you'll know where to turn for superior maintenance-of-way equipment.

At Fairmont, we've been building innovative maintenance-of-way equipment and tools since 1909. Our current product lines include motor cars and trailers, Hy-Rail® assemblies for rubber-tired vehicles, tie renewal and rail-gang equipment, machinery for rail grinding and bridge repair, and low-cost but efficient hand-held hydraulic tools.

For full information, write or call:
Fairmont Railway Motors, Fairmont,
Minnesota 56031, U.S.A. (507) 235-3361.

Fairmont®
...for help along The Way.
A DIVISION OF
harsco
CORPORATION

L

Lawson, C.J. (M'83), Ast. Rdm., CNW
Escanaba, MI 49829
Lawton, R.R. (M'65), ACE-Staff, C&NW
Chicago, IL 60606
Layer, J.P. (M'66, L'84), Ret. Sr. Engr.
R.W. Consultants, Inc.
212 Bavarian Dr., Spt. M
Middletown, OH 45042
Leach, L.J. (M'67), B&B Supv., UP
Kansas City, KS 66110
Ledingham, J.B. (A'75), President
Ocean Coatings Ltd.
Box 58354, Station "L"
Vancouver, BC
Lee, R.W. (M'61), Supv. B&B, Southern
Muscle Shoals, AL 25660
Lees, H.M., Jr. (M'71), Mgr. Trk. & Str. Res & Dev., BN, St. Paul, MN 55101
Lelevich, L.E. (M'67), Mgr. Budgets, UP
Salt Lake City, UT 84101
Lemanski, F.G. (M'76), Regional Engineer, N&W
St. Louis, MO 63147
Lewis, D.J. (M'73), Sr. Str. Designer, ICG
Chicago, IL 60601
Lileikis, J.A. (M'85), Engr. Insp., UP
Portland, OR 97227
Lindmark, C. (A'81), President
Atlantic Maintenance of Way Co.
5602 Pike Rd.
Rockford, IL 61111
Lindmark, K.L. (A'81), Vice President
Atlantic Maintenance of Way Co.
5602 Pike Rd.
Rockford, IL 61111
Line, A.G. (M'82), Elec. Asst. Engr., AT&SF
Los Angeles, CA 90040
Linn, G.A. (M'40, L'66), Ret. Div. Engr., C&NW
222 Chapin St.
Chadron, NE 69337
Linsteadt, J.C. (M'77), B&B Supt., MP
Spring, TX 77388
Lipkus, S. (M'82), Engr. Maint. Development, CN
Montreal, Que., Canada
Liston, C.L. (M'81), Gen. B&B Supv., UP
Pocatello, ID 83201
Lloyd, H.R. (M'66), B&B Supv., Southern
Stockbridge, GA 30281
Logan, J.M. (A'80), Asst. Gen. Mgr.
Conley Frog & Switch Co.
387 E. Bodley, Memphis, TN 38109
Lokey, L.N., Jr. (A'81), Area Mgr.
Osmose-Railroad Div.
P.O. Drawer O, Griffin, GA 30224
Lokotzke, G.P. (M'47, L'67), Ret. B&B Supv.
EJ&E, 1420 Meadow Dr.
Merrillville, IN 46410
Long, W.R. (M'63, L'83), Ret. Matr. Planner, SP
2320 S. Jackson, Albany, OR 97321
Longiotti, P. (M'74), Supv. Str., B&LE
Greenville, PA 16125
Lorenzini, J.L. (M'80), Sr. Proj. Engr., NIRC
Chicago, IL 60610
Love, J.J. (M'84), Engr. B&B, B&M
N. Billerica, MA 01862
Low, D. (A'85), Mgr. Subox Div., Carboline Co.
1401 S. Hanley Rd.
St. Louis, MO 63144

L

Lowry, J.M. (M'50, L'75), Ret. Asst. Div. Engr., SP
5242 Jackwood St.
Houston, TX 77035
Loyd, T.R. (M'85), Scale Insp., MP
Fort Worth, TX 86114
Lozano, D.E. (M'79), Gen. Fore. B&B, AT&SF
San Bernadino, CA 92411
Lund, C.R. (M'71), Eng. Mech., CMSP&P
Chicago, IL 60606
Lund, C.V. (M'47, L'71), Ret. Asst. to VP & CE
CMStP&P, 344 Scott Ave.
Glen Ellyn, IL 60137
Lurcott, E.T. (M'66), Engr. Sys. Insp. Str., Conrail
Philadelphia, PA 19104
Luzier, W.B. (M'85), Asst. Eng. Bridges, Southern
Atlanta, GA 30303
Lynch, J.F., Jr. (M'59), Engr. Des. & Cons., SP
San Francisco, CA 94105
Lynch, J.K. (A'51), Sales Manager
Vulcan Materials Co., P.O. Box 7497
Birmingham, AL 35253

M

Mabry, D.B. (A'48, L'73), Ret. VP-Sales
Moss-American, Inc., 420 Edgewood Dr.
St. Louis, MO 63105
Macfarlane, I.B. (M'81), Special Advisor Rwys.
Department of Trade, Australia
36 James St., Curtin Act. 2605, Australia
Mahoney, M.W. (A'81), President
Dodge Engineering Co., 8989 N. 138th St.
Omaha, NE 68142
Main, V.W. (M'76), Asst. Engr., AT&SF
Los Angeles, CA 90014
Makarowski, S. (M'64), Building Mgr., CN Rwys.
Bridges & Structures
Edmonton, Alb., Canada
Mansheim, R.C. (M'82), Asst. Engr., ATSF
Chicago, IL 60632
Margules, B. (A'83), Sales Mgr. Natl.
Hercules Machinery Corp.
1725 Edsell Ave.
Ft. Wayne, IN 46895
Markvaldas, T.E. (M'73), Asst. Br. Engr., CMSP&P
Chicago, IL 60606
Marlow, M.J. (M'72), Sup. Eng. Trks. & Prop.
EJ&E, Joliet, IL 60434
Martens, H.F. (M'82), Asst. Div. Engr., ATSF
Lubbock, TX 79408
Martin, J.W. (M'53, L'74), Ret. Mast. Carp, SCL
4656 E. Glen Ridge Circle
Winston, GA 30187
Martyn, G.W. (M'59, L'82), Ret. Mgr. Fac. & Civ. Engr., EJ&E
Joliet, IL 60433
Mascorro, F.F. (M'72), Gen. Fore., AT&SF
Fort Worth, TX 76102
Mashburn, J.I. (A'77), President
Ozark Railway Supplies, Inc., Corporate Centre
Suite 1-108, 1949 E. Sunshine
Springfield, MO 65804
Mathias, H.O. (M'59), Exec. Asst. Mgr. Conts., IHB
Hammond, IN 46323
Mattice, J.E. (M'81), B&B Supv., D&H
Oneonta, NY 13820

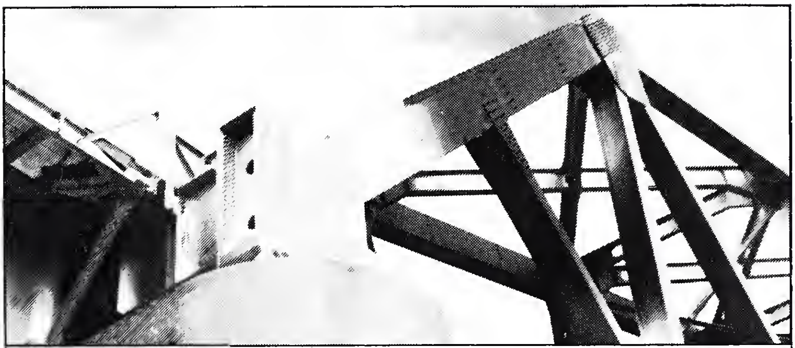
pile driving equipment

- Diesel Hammers & Accessories
- Semi Fixed Folding Leads — with Hydraulic Brace
- Spotters
- Power Packs
- Winches
- Rotational Power Monkeys

FEC®
THE FOUNDATION EQUIPMENT CORP.

354 Florence Ave., P.O. Box 566
Dover, Ohio 44622

call (216) 364-7521



Huckbolt® Fasteners Are Here To Stay

Just install 'em and forget 'em— no more safety worries and high maintenance costs associated with loose nuts and bolts. You can't beat the installed cost of a Huckbolt fastener either, whether holding together a bridge, turnout, crossing or track joint.

Another plus: unskilled labor can install them and deliver consistent high clamp-up fastenings every time. Call or write for a demonstration today. Huck Industrial Fastener Div., P.O. Box 8117, Waco, TX 76714, (817) 776-2000. Huck is a Federal-Mogul Company.

HUCK®

M

Maupin, A.J. (M'81), Sr. Draftsman, ICG
Chicago, IL 60601
Maxa, R.J. (A'83), Midwest Sales Mgr.
Pileco, Inc., 27150 Pillsbury Ave.
Lakeville, MN 55044
Mazza, E.A. (A'81), VP, Green Int'l., Inc.
504 Beaver St.
Sewickley, PA 15143
McBrien, W.H., Jr. (M'81), B&B Supv., B&LE
Monroeville, PA 15146
McCabe, J. (A'83), Gen. Mgr.
Midwest Indus. Prods. Corp.
3818 N. Clark St.
Chicago, IL 60613
McCammon, D.L. (M'84), Asst. Str. Engr., BN
Olathe, KS 66062
McCardle, T.W. (M'76), Rwy. Trk. Insp., APSC
Montgomery, AL 36130
McComb, E. (A'84), Dist. Mgr.
Fairmont Railway Motors
386 N. Wabasha, St. Paul, MN 55102
McCoy, D.E. (M'65), B&B Supv., BN
Denver, CO 80217
McFarland, D.E., (M'85), Asst. Gen. Fore. B&B
ATSF, LaJunta, CO 81050
McFarland, J.A. (M'71), Chrmn. Bd.
McFarland Johnson Engineers, Inc.
44 Cooper St., Woodbury, NJ 08096
McFarlin, R.J. (M'83), Dir. Transp. Engr.
Bakke, Kopp, Ballou & McFarlin Inc.
Minneapolis, MN 55401
McGill, J.A. (M'70), BYB Supv., Southern
Hattiesburg, MS 39401
McGinley, M.E. (M'84), Ast. Engr. M/Way, SP
Houston, TX 77251
McGuire, R.F. (A'71), Area Mgr., Osmose Co.
14627 W. 89th St., Lenexa, KS 66215
McKenzie, L.E. (M'78), WS Supv., UP
Portland, OR 97227
McMaster, M.C. (M'78), Supv. Strs., Conrail
North Ridgeville, OH 44039
McMaster, R.C. (M'66, L'82), Ret. Mgr. Fac. &
Strs., B&LE, 318 N. Clinton St.
Greenville, PA 16125
Meek, H.V. (M'83), Gen. Rdm., DRGW
Grand Junction, CO 81506
Meeker, D.L. (A'83)
728 S. 33rd Street
Mattoon, IL 61938
Meisner, D.C. (M'76), Asst. to Br. Engr., CNW
Chicago, IL 60606
Mentzer, H.T. (M'83), B&B Supv., Amtrak
Philadelphia, PA 19103
Messman, D.V. (M'55, L'74), Ret. Asst. to
Ch. Engr., Southern
2434 Shallowford Rd. NE
Atlanta, GA 30345
Meyer, J.J. (A'80), VP&GM M/Way
Western-Cullen-Hayes Inc.
120 N. 3rd St.
Richmond, IN 47374
Meyers, B.R. (M'30, L'68), Ret. VP, C&NW
569 Winnetka Ave.
Winnetka, IL 60093
Michael, R.G. (M'85), President
CDC Services
Elk Grove Village, IL 60007

M

Michaud, S.A. (M'81), Trk. Surv. Eng.-Cartier
Pt. Cartier, PQ, Canada
Michel, J.N. (M'79), Sr. Dir. Eng. Des., Amtrak
Philadelphia, PA 19104
Miedtke, D.R. (M'80), Proj. Mgr., Ellerbe
Bloomington, MN 55420
Miller, D.E. (M'67), B&B Supv., UP
Cheyenne, WY 82001
Miller, J.C. (M'69, L'82), Ret. Eng. Admin., WP
P.O. Box 930, Chester, GA 96020
Millsap, S.A. (M'84), Br. Engr., BN
Springfield, MO 65802
Mimick, F.A. (M'67, L'82), Ret., UP
6119 S. 94th Circle, Ralston, NE 68127
Monahan, E.L. (M'68, L'84), Ret. Surveyor, CRI&P
727 7th St., LaSalle, Il 61301
Moore, D.L. (M'85), Eng. Brdg./Mtnc., SP
Houston, TX 77002
Moore, D.W. (M'83), B&B Supv., Southern, SP
Ennis, TX 75119
Moore, I.A. (M'39, L'61), Ret. Chf. Engr., C&EI
2321 N. Vermillion St., Danville, IL 61832
Moore, R.M. (M'65), Gen. Engr., FRA
Washington, D.C. 20590
Moorhead, W.H. (A'84), Gen. Mgr.
SRS America Co., P.O. Box 839
Southbury, CT 06488
Morey, C.F. (M'80), Sr. Str. Insp., Conrail
West Chester, PA 19380
Morris, D.A. (M'82), Div. Engr., AT&SF
San Bernardino, CA 92410
Mueller, R. (A'85), President
Templeton Kenley & Company
2525 Gardner Rd., Broadview, IL 60153
Munoz, J.M. (M'81), B&B Supv., MP
Houston, TX 77028
Murdock, G.L. (M'72), Engr. M/Way, SP
San Francisco, CA 94105
Murphy, M.D. (M'80), Str. Designer, CMSP&P
Chicago, IL 60606
Murray, D.J. (M'54), Land & Tax Comm., BRCC
Chicago, IL 60638
Myers, E.T. (M'57, L'80), Ret. Engr. Editor
Modern Railroads
3631 W. 213th St., Matteson, IL 60443
Myers, R.L. (M'50, L'76), Water Chem., ICG
520 Wabash Ave., Apt. 10
Mattoon, IL 61938

N

Napoli, J. (M'78), B&B Supv., BRCC
Chicago, IL 60638
Nash, W.R. (M'84), Proj. Director
McCarthy Brothers Co.
St. Louis, MO 63144
Neece, J.L. (M'83), Br. Insp., Seaboard
Nashville, TN 37211
Nejak, K.R. (A'83), Mgr., Br. Section
Green International Inc.
504 Beaver St., Sewickley, PA 15143
Nelson, A.F. (M'81), Proj. Eng.
Gannett Fleming Inc.
Harrisburg, PA 17105
Nelson, H.F. (M'70), Dir. Eng. Serv., EJ&E
Joliet, IL 60434

HELP YOURSELF

Eliminate maintenance problems by restoring unsafe structures

■ Let Prepakt provide specialized supervision and equipment plus a half-century of know-how to help put your concrete and masonry structures in good-as-new condition.

Prepakt is geared to handle rehabilitation work in two ways subject to your specific needs. We can work with your crews — or — we can take on the whole project. The result is the same — top quality restoration at a fraction of replacement cost.

Call us today — Area Code 216/623-0080.

INTRUSION-PREPAKT, INC.
1705 The Superior Bldg., Cleveland, Ohio 44114
In Canada: 89 Langstaff Road East, Thornhill, Ontario L3T 4A5

Structure Repair and Rehabilitation • Tunnel Grouting • Augered Piling • Erosion Control Systems

N

Nelson, J.H. (M'74), B&B Supv., MP
Monroe, LA 71201

Nelson, R.D. (M'57), Dir. Qual. Cont., C&NW
Boone, IA 50036

Nelson, W.H. (M'82), Ast. Mgr., B&B Train., BN
Kansas City, KS 66103

Nesbitt, S.A. (M'81), Designer, ICG
Chicago, IL 60601

Newberry, A.C. (M'82), Dist. Engr., AT&SF
Los Angeles, CA 90040

Nicely, C.M. (A'80), Pres., The RG Smith Co.
1249 Dueber Ave. S.W.
Canton, OH 44711

Nickerson, C.A. (M'82), Div. Engr., AT&SF
Amarillo, TX 79171

Nicolau, A.M. (M'84), Reg. Director
Steinman Consulting Engineers
New York, NY 10004

Niemeyer, T.M. (M'73), Engr. Pub. Wks., C&NW
Torrington, WY 82240

Nitzschke, R.D. (M'74), B&B Supv., C&NW
Pekin, IL 61554

Nordstrom, R.D. (M'59), Engr. Br. & Str., UP
Oakland, CA 94607

Norton, K.J. (A'71), Mgr. Sales
Osmose Wood Preserving Co.
4645 Tompkins Dr.
Madison, WI 53716

Novick, D.A. (A'85), Sr. Vice President
Parsons Brinckerhoff Quade & Douglas
111 W. Jackson Blvd.
Chicago, IL 60604

Noyszewski, M. (M'65), Engr. Bridges, ICG
Chicago, IL 60601

O

O'Connor, B.J. (M'85), Sys. Supv., CN
Montreal, Que., Canada

Oest, W.C. (M'47, L'61), Ret. Prin. Asst. Engr.
FW&D, 4633 Chalmont
Fort Worth, TX 76107

Olson, D.D. (M'81), Ast. B&B Supv., C&NW
Mt. Prospect, IL 60056

Oncu, I. (M'84), Manager Bridge & Tunnel Des.
Amtrak, Philadelphia, PA 19103

Oram, D.A. (M'82), Asst. Engr. Constr. Br.
Seaboard, Jacksonville, FL 32202

Ostby, David J. (A'85), Product Specialist, Osmose
Madison, WI 53708

Osterling, A.W. (M'77), Vice President
McFarland Johnson Engineers
Woodbury, NJ 08096

Ostrom, W.D. (M'54, L'75), Ret. Ch. Carp
CMSP&P, Reads Landing, MN 55968

Owens, R.F. (M'65, L'83), Ret. Cost Engr., ICG
10037 S. Charles
Chicago, IL 60643

P

Packard, B.G. (M'54, L'70), Ret. Off. Eng., C&NW
1605 Delaware, Sturgeon Bay, WI 54235

Pahl, W.H. (M'50, L'64), Ret. Ast. Supvr. Str., Penn
2211 Walshire Ave., Baltimore, MD 21214

Palmer, J.F. (A'71), Exec. VP
J&P Petroleum Product, Inc.
P.O. Box 4206, Dallas, TX 75208

P

Parker, T.J. (M'84), Proj. Mgr.
Envirodyne Engineers, Inc.
Chicago, IL 60606

Parrish, O.S. (M'67, L'84), Ret. Gen. BB-WS
Foreman, ATSF
Wellington, KS 67152

Partilla, J.S. (M'81), Bldg. Mtce. Engr., B&LE
Monroeville, PA 15146

Parvin, C.F. (M'78), Consulting Eng.
41 Briar Rd., Wayne, PA 19087

Patel, N.S. (M'84), Br. & Str. Engr., GTW
Detroit, MI 48226

Patterson, C.C. (M'58, L'75), Ret. B&B Supv., BW
Alliance , NE 69301

Patterson, J.M. (M'57, L'75), Ret. B&B Supv., PC
32 Hillside Rd., Beacon, NY 12508

Patton, R.D. (M'79), B&B Supv., Southern
Princeton, IN 47670

Paxton, W.R. (M'72), Ch. M/W Div., FRA
Manassas, VA 22110

Payne, R. (M'85), Proj. Mgr., ESCA Consultants
1606 Willow View Road, P.O. Box 159
Urbana, IL 61801

Pearson, R.E. (M'63), Ch. Engr., C&IM
Springfield, IL 62705

Pearson, W.O. (A'64), RR Engr.
Sverdrup and Parcel Inc.
800 N. Tucker, St. Louis, MO 63101

Pebler, J.A. (M'84), B&B Supv., NIRC
Blue Island, IL 60406

Perkins, G.L. (A'83), Sales Rep.
Pandrol, Inc., P.O. Box 367
Bridgeport, NJ 08014

Perrier, J.L. (M'53, L'75), Ret. Dir. Spec.
Projs. Eng., CNW
1331 S. Finley Rd., Lombard, IL 60148

Perry, G.E. (M'84), Bridge Inspector, MP
Salem, IL 62881

Peters, D.R. (M'85), B&B Supv., UP
Omaha, NE 68154

Petroski, G.J. (M'81), Project Eng., Conrail
Schnecksville, PA 18078

Phillips, L.A. (M'81), Engr. Fac. Maint., WT/Amtrak
Washington, D.C. 20002

Phillips, R.E. (M'78), Ast. Arch. Engr., Southern
Atlanta, GA 30303

Picken, A.R. (M'81), Supv. Mtce. & Stru., B&A
Bangor, ME 04401

Piepmeier, A.L. (A'53), VP-Turner Engr. Co.
P.O. Box 150329, Nashville, TN 37215

Pierce, C.D. (M'72), Engr. B&B, B&M
N. Billerica, MA 01862

Pittinger, D.A., Sr. (A'84), Natl. Sales Mgr.
RR Prod., Lone Star Industries
Portage, MI 49002

Pitzen, G.B. (M'83), Rdm.-Proj. Engr., RTA
Chicago, IL 60610

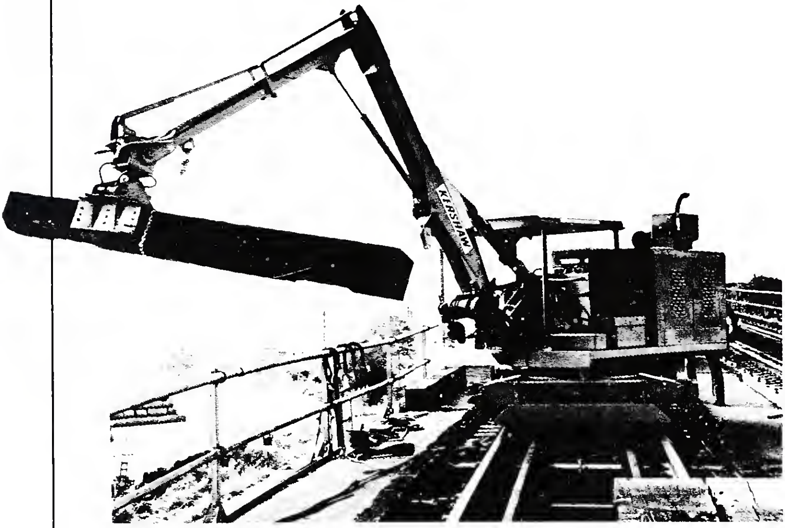
Porter, D.C. (M'71), Asst. Str. Supt, ON
North Bay, Ont., Canada

Posthauer, R.J. (A'81), Sr. Vice Pres.
Seeley Stevenson Value & Knecht
225 Park Ave. So, New York, NY 10003

Potter, R.H. (M'66), Engr. Strs., MC
Portland, ME 04104

Pratt, C.O. (A'80), Mgr. Spec. Servs.
Koppers Co., Inc., RD #2, Box 332
Valencia, PA 16059

The
Bridge Crane



The Kershaw Bridge Crane is the answer to safe, efficient bridge and open-deck trestle work. Bridge ties, caps, and stringers can be replaced quickly with a minimum requirement of people on the bridge.

Kershaws' uniquely designed grapple enables the operator to clamp the tie close to one end for optimum maneuverability. The 4,000 pound capacity winch easily handles caps and stringers within a radius of 10 feet from the track centerline, while locking rail dogs allow the operator to perform all operations under maximum safety conditions.

KERSHAW

Kershaw Manufacturing Company, Inc.
P.O. Box 9328
Montgomery, Alabama 36196
Telephone: (205) 263-5581

P

Presthus, E.J. (M'64, L'80), Ret. Engr. Str., BN
126 E. Central Ave., Missoula, MT 59801
Price, R.W. (M'80), Gen. Fore., B&B, WS, ATSF
La Junta, CO 81050
Pritchard, B.L. (M'56, L'69), Ret. Div. Eng., ATSF
2204 S. Travis, Amarillo, TX 79109
Pritchett, J.S. (M'61), Gen. B&B Supv., Southern
Columbus, GA 31902
Prude, G.F. (M'51, L'75), Ret. Asst. B&B Supv., SP
P.O. Box 1319, Houston, TX 77001

Q

Quesada, J.M. (M'82), Asst. Engr., Br. Insp.
AT&SF, Los Angeles, CA 90040

R

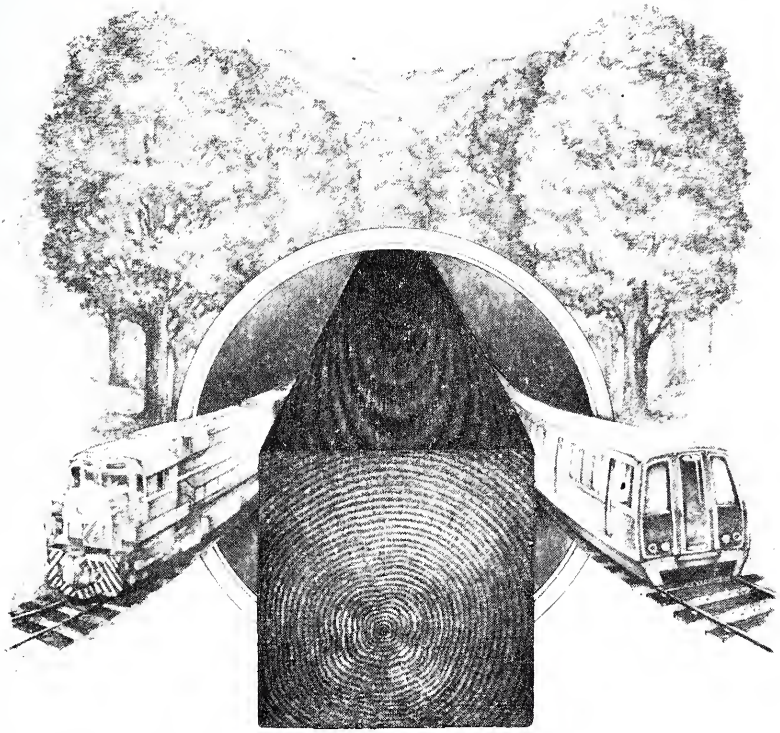
Raessler, V.D. (M'51, L'71), Ret. Sup. B&B&WS, IC
Memphis, TN 38114
Rainer, A.L. (M'68, L'83), Ret. Ch. Br. Insp.
Seaboard, Russell Rd., Box 1470
Green Cove Springs, FL 32043
Rainey, W.H. (M'56, L'69), Ret. B&B Sup., SP
201 W. Fair Oaks Place, San Antonio, TX 78209
Rains, J.E. (M'71), Eng. Dsgn., Seaboard
Jacksonville, FL 32202
Ramsauer, R. (M'77), B&B Mast., AC
Sault St. Marie, ON, Canada
Rankel, V.J. (M'83), Asst. Gen. Br. Insp., CNW
Chicago, IL 60606
Rankin, W.H. (M'61, L'81), Ret. Sr. Str. Eng., BN
251 E. Bennett, Springfield, MO 65807
Rauch, D.L. (M'74), Ch. Engr., PB&NE
Bethlehem, PA 18015
Raymond, J.R. (M'80), B&B Supt., MP
Dallas, TX 75207
Reeder, D.T. (M'67), Gen. B&B Supvr., UP
Los Angeles, CA 90022
Rees, F.L. (M'66, L'81), Ret. Eng. Trk., AT&SF
P.O. Box 384, Colwich, KS 67030
Memphis, TN 38101
Reger, J.H. (M'65, L'80), Ret. Des., ICG
2068 Lioncrest Dr.
Richton Park, IL 60471
Reilly, W.C. (A'60), Chrmn. Gd., Gen. Mgr.
Conley Frog & Switch Co.
387 E. Bodley Ave., Memphis, TN 38109
Reis, J.R. (A'71), VP Operns, Mobley Co. Inc.
P.O. Box 542, Fayette, MO 65248
Releford, C.R. (M'67), Gen. Fore. B&B & W.S.
AT&SF, Lubbock, TX 79407
Reynolds, T.A. (M'61), Mgr. Opers. Imp., Conrail
Detroit, MI 48216
Richter, J.S. (M'79), Eng. Strs., Conrail
Pittsburgh, PA 15870
Rimmereid, J.J. (M'84), Engr. Design, BN
Naperville, IL 60540
Robertson, H.G. (A'82), Chrmn. Bd., Railhd. Corp.
9730 S. Western Ave.
Evergreen Park, IL 60642
Robertson, J.G. (M'74), Mgr. Engr. Desg., B&LE
Monroeville, PA 15146
Robinson, G.E. (M'48, L'62), Ret. ACE, NYC
5986 Hibiscus Dr.
Bradenton, FL 33507
Rogers, S.M. (M'84), Steel Br. Insp., ATSF
Amarillo, TX 79171

R

Rollings, R.I. (M'73), Ret., N&W
Hazelwood, MO 63042
Rood, C.L. (M'84), Ast. Supvr. Strs., Amtrak
Philadelphia, PA 19104
Rosenkrantz, F.E. (M'78), Eng. Des. & Con., GTW
Detroit, MI 48226
Ross, C.E. (M'70), Ch. Engr., KCT
Kansas City, MO 64141
Roth, D.B. (M'82), Br. Engr., BN
Naperville, IL 60540
Rothell, R.D. (M'57, L'72), Ret. Gen. B&B Sup.
Southern, Rt. 3, Box 239
Westminster, SC 29693
Rougas, M. (M'75), Asst. VP R&T, AAR
Washington, D.C.
Rotondo, E.J. (M'82), Br. Engr., ATSF
Chicago, IL 60606
Runde, E.E. (M'59, L'80, H'82), Ret. Con. Eng.
Str., IC, 154 Wisconsin Ave.
E. Dubuque, IL 61025
Rundell, L.E. (M'76), Supv. M/W Train, AT&SF
Alburquerque, NM 87102
Russell, C.M. (M'73), B&B Supvr., Southern
Kernersville, NC 27284

S

Safley, J.R. (M'45, L'68), Ret. B&B Supv., SP
3624 San Benito St., San Mateo, CA 94403
Saletnik, P.H. (M'74), Engr. Bldgs., C&NW
Chicago, IL 60606
Salmon, J.M., Jr. (M'38, L'69), Ret. Ch. Engr.
Clinchfield, Erwin, TX 37650
Sams, A.L. (A'71),
1121 Braeburn Rd., Flossmoor, IL 60422
Sanders, M.R. (M'83), Sr. Elect. Engr., Amtrak
Philadelphia, PA 19104
Sarris, P.T. (M'55), Asst. Ch. Engr., D&C, Southern
Atlanta, GA 30303
Sartore, D.V. (M'61), Ch. Engr. Des., BN
Overland Park, KS 66210
Sathre, C.O. (M'50, L'71), Ret. B&B Sup., C&NW
281 Harruby Dr., Calimesa, CA 92320
Saunders, T.D. (M'30, L'66), Ret. Dir. Plan. & Res.
ON, North Bay, ON
Saxton, C.L. (M'83), B&B Supvr., UP
Green River, WY 82935
Schapp, R.D. (M'85), Reg. Asst. B&B Supvr., BN
Billings, MT 59101
Schlaf, E.R. (M'47, L'76, H'76), Ret. Supt.
Fire Prev., ICG
2136 W. Howland, Chicago, IL 60620
Schlehuber, R.L. (M'75), Water Serv. Supvr., UP
Pocatello, ID 83201
Schlicher, G.K. (M'67, L'83), Ret. B&B Supvr.
Conrail, 3425 Chamberlain Dr.
Indianapolis, IN 46227
Schleuter, G.A. (M'77), Reg. Sales Mgr.
Railway Track & Structures Railway Age
Chicago, IL 60602
Schmitz, J.F. (M'60, L'81), Ret. B&B Supt., MP
9209 Cloverhill Rd., Little Rock, AR 72205
Schoen, W.F. (M'81), Asst. Ch. Engr. Constr.
Conrail, Philadelphia, PA 19104
Schoulties, A.P. (A'75), Serv. Engr., Armco Inc.
Constr. Prods. Div., 1001 Grove St.
Middletown, OH 45042



The Ever-Dependable Wood Crosstie

(Good news down the line)

In this world of shrinking natural resources, it's comforting to know there's at least one resource that is literally *growing: The proven, dependable wood crosstie. We're growing them faster than we're using them.*

It's a good thing. On down the line, we'll need 30 million new crossties a year to keep America rolling. That's a pretty tall order. But Man and Nature—working together—began filling it years ago.

In the century and a half since crosstie technology emerged from the stone age, modern improvements in drying and treating wood have extended the average life of the crosstie five fold from about six years to 30 years and up.

Today, the modern wood crosstie lasts longer than it takes to grow a tree big enough to make one or more new crossties.

Nature is doing her part, too. Hardwood growth now *exceeds* annual cutting by more than 75%. And that inventory—especially in crosstie-size trees—is increasing.

American Commerce has a lot riding on the strength and growth of the Nation's Railroads. And our Railroads can bank on the ever-dependable wood crosstie to carry its share of the load. Right down the line.

Koppers Company, Inc.
Pittsburgh, PA 15219

KOPPERS

Architectural and
Construction Materials

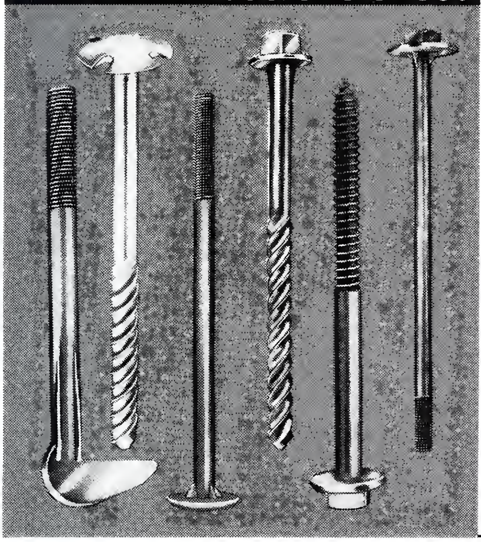
S

Schwab, B.R. (M‘84), Staff Engr. Projs., LI
Jamaica, NY 11435
Scott, G.E. (M’69, L’83), Ret. Sys. Supvr. Br. & Str.
CN, 165 Ontario St., Apt. 706
Kingston, Ont., Canada
Scroggs, J.E. (A’58), Pres., Railway Techniques
3316 Broadway, Kansas City, MO 64111
Seay, F.S., Jr. (M’79), Br. Engr. Mtce. & Const.
Seaboard, Jacksonville, FL 32202
Seley, L.L. (M’53, L’74), Ret. B&B Supvr., BN
4908 Prospect Ave., Hannibal, MO 63401
Seltzer, J.W. (M’58, L’76), Sr. Civil Engr., PC
604 Phaeton Pl., Indianapolis, IN 46227
Semioli, W.J. (M’78), Editor RT&S
Chicago, IL 60602
Shamblin, H.A. (A’65), Dir. Constr. Conts.
Carolina Power & Light Co.
7709 Harps Mill Rd., Raleigh, NC 27609
Shamblin, R.E. (M’57, L’74), Ret. Div. Eng., Mtce
N&W, 2012 East River Ave.
Bluefield, WV 24701
Shaver, J.R. (M’81), B&B Supv., N&W
Bluefield, WV 24701
Shaw, D.E. (M’84), Br. Supvr., MP
N. Little Rock, AR 72114
Sheffield, J.J. (M’72), B&B Supvr., Seaboard
Effingham, SC 29541
Sheldon, E.B. (M’85), Plant Mgr., Crosstie, FEC
Jacksonsville, FL 32216
Shepherd, J.R. (M’78), B&B Supvr., Southern
Columbia, SC 29201
Short, W.L. (M’51, L’75), Ret. Br. Mtce. Engr., MP
526 Ambergate Dr., Webster Grove, MO 63119
Shugart, F. (A’85), President
Shugart Mfg. Inc., P.O. Box 748
Chester, SC 29706
Shugart, L. (A’85), Ch. Engr.
Shugart Mfg. Inc., P.O. Box 748
Chester, SC 29706
Simonsen, E.F. (M’58, L’73), B&B Supvr., SI
P.O. Box 483, Sandpoint, ID 83864
Sinclair, C.H. (M’54, L’76), Ret. B&B Supv., CNW
1210 SE 22nd Terr., Cape Coral, FL 33904
Skoglund, E.E. (M’83), Proj. Mgr.
Schnabel Foundation, Bedford, NH 03102
Slagle, G.P. (M’48, L’67), Ret. Ch. Carp.
CMSP&P, 5510 N. Iroquois Ave.
Milwaukee, WI 53217
Sliepka, R.B. (M’69), Sys. Eng. Plng. & Dev., EJE
Joliet, IL 60434
Small, F., Jr., (M’83), Proj. Sup. B&B, Southern
Plymouth, NC 27962
Smedley, E.F. (M’83), Gen. B&B Supv., UP
Portland, OR 97227
Smedley, V.N. (M’65, L’84), Ret. Field Constr.
Engr., UP, 3514 S.E. Skogan Rd.
Sandy, OR 97055
Smith, C.D. (M’84), Asst. Gen. Fore. B&B, ATSF
Amarillo, TX 79102
Smith, J. (M’43, L’70), Ret. B&B Supvr., SP
1557 Frienza Ave.
Sacramento, CA 95825
Smith, J.H. (M’73), Engr. Bldgs. & Fac., ICG
Chicago, IL 60601
Smith, J.R., Jr. (M’76), Eng. M/W, RF&P
Richmond, VA 23230

S

Smith, N.A. (M’81), Str. Designer, MP
St. Louis, MO 63103
Smith, N.E. (M’66), AVP Ch. Engr., CMSP&P
Chicago, IL 60606
Smith, R.H. (M’57, L’81), Ret. Ch. Eng. M/W, CR
759 Richards Rd., Wayne, PA 19087
Smith, T.J. (M’84), B&B, WS Supvr., BN
Amory, MS 38821
Smithberger, T.P. (M’79), Ast. Trk. Supvr., Union
Duquesne, PA 15110
Snyder, J.D. (M’77), Supvr. Strs., B&LE
Butler, PA 16001
Synder, R.E. (M’61), Ast. Ch. Engr., Mtce., CNW
Chicago, IL 60606
Solarte, H. (M’63), Principal Sr. Civil Engr.
Arrendo, Epperson, Solarte & Brunz
13667 Floyd Circle, Dallas, TX 75243
Soles, J.W. (M’79), Asst. Supvr., B&B, Seaboard
Clayton, NC 27520
Sorensen, N.N. (M’67, L’82), Ret. B&B Supvr., UP
5005 N. 107th St., Omaha, NE 68134
Sorgenfrei, D.F. (M’81), Cons. Engr.
Modjeski & Masters
New Orleans, LA 70130
Sparrow, R.W., Jr. (M’83), Des. Cons. Mgr.
Schnabel Foundation Co.
Bethesda, MD 20816
Spencer, B.S. (M’65), Str. Supt., ON
North Bay, ON
Spencer, G.D. (A’80), President
Spencer Dynamics Corp.
10 Dunnell Lane, Pawtucket, RI 02860
Spicer, C. (M’85), Sr. Engr. Coordinator
Canadian Transport Commission
Ottawa, ON, Canada K1Z 7L1
Stade, A.F. (M’62, L’84), Ret. Engr. Br. Maint. SP
4123 Clear Spring, San Antonio, TX 78217
Stander, N.R. (M’84), Br. Insp., West Dist., MP
Kansas City, MO 64120
Stanley, J.F. (M’75), Supvr. Br. Mtce., CMSP&P
Chicago, IL 60606
Stavenjord, R.U. (M’67), Gen. B&B Supv.
Alaska Ry., Alaska 99510
Stead, M.E. (M’81), Str. Des., MP
St. Louis, MO 63101
Stearman, J. (M’79), Res. Engr., Amtrak
Baltimore, MD 21201
Steele, D.L. (M’81), B&B Supvr., UP
Omaha, NE 68118
Steelman, H.C. (M’80), Div. Engr., MP
N. Little Rock, AR 72116
Steiner, G. (M’81), Architect, C&NW
Oak Park, IL 60301
Stephens, T.J. (M’58, L’82),Ret. Asst. to Div.
Engr., UP, 6645 Bellefountain
Kansas City, MO 64132
Stewart, B.J. (M’85),Associate
Riley, Park, Hayden & Associates, Inc.
Atlanta, GA 30303
Stokely, W.S. (M’65), Engr. Des. & Cons., ICG
Chicago, IL 60601
Stoker, R.G., Jr. (M’85), Asst. B&B Sup., Southern
Selma, AL 36701
Stokes, W.F. (M’71), Supv. Rdwy. Mach., ICG
So. Chicago Heights, IL 60411

SEALTITE® PRODUCTS FOR EVERY NEED... ...CALL 1-800-328-3480!



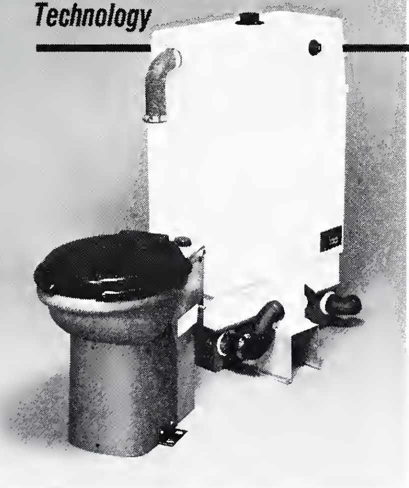
- ➠ Dome-head drive spike
- ➠ Spike-driver tool
- ➠ Spike-driver adapter
- ➠ Washer-head timber drive spike
- ➠ Washer-head lag screw
- ➠ Hook bolt
- ➠ Ever-tight bolt assembly
- ➠ Spring lock
- ➠ Washer nut
- ➠ Guard-rail dome-head bolt
- ➠ Washer-head timber bolt
- ➠ Adjustable combination counter-bore-&-machine bit
- ➠ Hex bridge bolts
- ➠ Drift pins
- ➠ Car (wood) bolt
- ➠ Flat-head square-neck carriage bolt

Special fasteners of all kinds.

LEWIS
BOLT & NUT COMPANY
504 Malcolm Ave. S.E., Minneapolis, MN 55414

M I C R O P H O R

Microphor Quality Makes The Difference In Rail Sanitation Technology



Flow Through Action Means More Reliable, Economical Operation.

That's why some 50,000 on-board sewage handling and treatment systems have been installed by more than 200 railroads worldwide. Microphor has become recognized as the standard of quality for rail sanitation technology.

Microphor systems include air-assisted, half-gallon flush toilets, biological treatment tanks, chlorinators and a variety of optional equipment. Simple, low-cost operation is activated by train air. There are no recirculated fluids or vapors, such as those emitted by incinerated wastes. Harmful organisms are destroyed and treated liquid waste is discharged directly to the roadbed.

Flexible and custom installations for locomotives, cabooses, commute, crew, passenger and private cars. Microphor systems meet tough standards set by the Food and Drug Administration, Environmental Protection Agency and recommended by the Association of American Railroads.

Microphor, Inc.
452 East Hill Road, P.O. Box 490
Willits, CA 95490
Telephone 800 358-8280, toll free
In California 707 459-5563
Telex 330470

Microphor Export Corp.
Forest Lodge West, Fawley Road
Hythe, Southampton, SO46ZZ,
England
Telephone 0703/843178
Telex 477580 Hovcon G

Microphor Europe GmbH
Postfach 80 03 59
Huttenstrasse 45
4320 Hattingen, West Germany
(0 23 24) 29-5546
Telex 8229974 Answer Back THH D

MICROPHOR®
a HARROW company

® Registered trademark of Microphor, Inc.

S

Stokke, T.O. (M’77), Ch. Engr., LS&I
Marquette, MI 49855
Storer, J.W. (A’61), Vice President
Osmose Wood Preserving Co., P.O. Box 8276
Madison, WI 53708
Storey, H.E. (M’82), Ch. RR Accid Div., NTSB
Washington, DC 20594
Stout, T.P. (A’75), Vice President
Atlas Services Corp., RD #2 Box 80
Washington, PA 15301
Sturm, W.C. (M’62), Sr. Proj. Engr., EJ&E
Joliet, IL 60434
Swanson, W.C. (M’63, L’84), Ret. B&B Insp.
Conrail, P.O. Box 64, Knox, IN 46534
Switzer, G. (M’48, L’66), Ret. Gen. Supv. St. &
Wk. Equip., WP, 379 Slater Ave.
Oakland, CA 94610

T

Tack, H. (M’82), B&B Foreman, DW&P
Virginia, MN 55792
Tallent, R.A., Jr. (M’81), Proc. Engr. Str., Southern
Atlanta, GA 30303
Tanner, R.J. (M’82), Mgr. M/W Train., ATSF
Albuquerque, NM 87102
Termunde, W.L. (M’56, L’77), Ret. Eng. M/W
BRCC, 9544 S. 49th Ave., Oak Lawn, IL 60453
Tetreault, L.J. (M’36, L’71), Ret. B&B Fore., PC
P.O. Box 956, Edgewater, FL 32032
Thatcher, C.H., Jr. (M’58, L’76), Ret. Div. Office.
Engr., C&NW, 528 Dakota St.
Shakopee, MN 55379
Thielemeyer, R.L. (M’81), Sr. Br. Design Eng., MP
St. Louis, MO 63103
Thompson, C.E. (M’76), B&B Master, CP Rail
Burnaby, B.C., Canada
Thompson, W.C. (M’81), Div. Engr., MP
Overland Park, KS 66214
Thum, W.A., Jr. (M’61, L’83), Ret. Eng.
Undercutting, Amtrak, 1414 Ship Rd.
West Chester, PA 19380
Tieman, L.G. (M’71, L’83), Ret. Adm. Engr.
C&NW, W170N8935 Hoyt Dr.
Menomonee Falls, WI 53051
Tiesling, A.J. (M’69), Mgr. Structures C&NW
Milwaukee, Wi 53225
Toftoy, D.K. (M’75), Mgr. Fac. & Civil Engr., EJ&E
Joliet, IL 60434
Triplett, Tom (A’85), Vice President
Shugart Mfg. Inc., P.O. Box 748
Chester, SC 29706
Truitt, G.T. (M’82), Asst. Div. Engr., AT&SF
San Bernardino, CA 92410
Trulove, J.D. (M’45, L’71), Ret. B&B Supv., SP
Sacramento, CA 95816
Tucker, N.R. (M’39, L’59), Ret. ADE, T&NO
P.O. Box 4030, Houston, TX 77001
Tustin, E.O. (M’62, L’78), Ret. B&B Supvr., ICG
921 Terrace Dr., Glenwood, IL 60425
Tyckoson, E.G. (M’54, L’68), Ret. Ch. Car.
CMSP&P, 2517 N. Lawndale Ave.
Chicago, IL 60647
Tyler, W.R., Jr. (M’59, L’78), Ret. Engr. Cons.
UP, 875 Donner Way No. 604
Salt Lake City, UT 84108
Tysinger, G.L. (M’71), Prin. Tysinger Engrg.
Erwin, TN 37650

U

Updike, D.E. (M’83), Proj. Eng., UP
Portland, OR 97227
Uppal, A.S. (M’80), Reg. Engr., Br. Strs., CN
Winnipeg, Man., Canada

V

Van Huis, J.A. (M’85), Brdg., Engr., CNW RR
Chicago, IL 60606
VanScoyoc, L. (M’60, L’79), Ret. Architect, ICG
2801 S. King Dr., Chicago, IL 60616
Veitch, D. (M’78), Ret. Br. & Str. Engr., GTW
Windsor, ON, Canada N8S 4A1
Viehweg, P.F. (M’66), Sr. Proj. Engr., EJ&E
Joliet, IL 60434
Vines, H. (M’79), Supt. B&B, TRRA
Granite City, IL 62040
Virrill, W.G. (M’83), Engr. Constr., Conrail
Detroit, MI 48216
Von Behren, G. (M’56, L’70), Ret. Asst. Supv.
Str., PC, 6015 Burgess Ave.
Baltimore, MD 21214

W

Wachter, C.E. (M’57, L’71), Ret. B&B Mast., CN
1470 Ayre Ave., Kelowna, BC, Canada
Wagner, W.R. (M’81), Sys. Engr. Constr., Conrail
Philadelphia, PA 19104
Walbrun, M.C. (M’84), Mgr. Eng. Design, Amtrak
Philadelphia, PA 19104
Wahlen, C.R. (M’81), Br. Engr. Sys., ATSF
Chicago, IL 60632
Waisanen, R.M. (M’63, L’82), Ret. Asst. Arc.
Engr., C&NW, 1309 Hillside
Berkley, IL 60163
Walbrun, M.C. (M’84), Mgr. Engrng. Des., Amtrak
Philadelphia, PA 19104
Wall, R. (M’48, L’70), Ret. B&B Supvr., Southern
4004 Merrifield Dr., Selma, AL 36701
Wallace, J.W. (M’84), Bridge Inspector, MP
N. Little Rock, AR 72114
Walsh, R.H. (A’73), Gen. Sales Mgr.
Holland Co., Railweld Div., 1020 Washington Ave.
Chicago Heights, IL 60411
Walls, D.R., Jr. (M’84), B&B Supvr., SP
Houston, TX 77001
Waltemath, T.F. (M’85), B&B Supvr., UP
Hershey, NE 69143
Wang, A.B. (M’50, L’63), Ret. Supvr. B&B, Monon
303 Murphy St., Lafayette, IN 47905
Warfield, H., Jr. (M’52, L’66), Ret. Insp. M/W
Penn, 9242 Silver So. D.
Columbia, MD 21045
Warfield, W.B. (M’51, L’70), Ret. Mat. & Eqpt.
Engr., PC, 61 Burkleigh Road
Baltimore, MD 20104
Warner, D.R. (A’83), Div. Mgr., Haskinstrand Div.
Wallace Mfg. Co., 1300 W. Diversey Parkway
Chicago, IL 60614
Webb, H.G. (M’82), Ch. Engr., AT&SF
Chicago, IL 60632
Weerasuriya, J.P. (M’80), Dist. Engr., MAHAWELI
Hikkaduwa, SRI-LANKA, Ceylon
Welch, K.R. (M’83), Dist. Engr., MP
N. Little Rock, AR 72114

LITTLE *Giant* CRANE AND SHOVEL, INC.

HIGH-RAIL SNOOPER®
Better, easier bridge inspection and maintenance; mounted on LITTLE GIANT HIGH-RAIL CARRIER equipped with Diesel Engine, Remote Contro, Automatic Full-Reversing Transmission, allows controlled movement and complete coverage. 2 x 14 foot platform, with controls, enables operator to position and work as far as 25 feet below deck.

P-M PaxMite
PAXTON-MITCHELL company
27th & Martha Streets • Omaha, Nebraska 68105

Full pick and carry crane capacity on rail

LITTLE GIANT TRAKRANE®

Tractive effort to pull several work cars

Four speed automatic transmission
Full reversing auxiliary transmission
Remote control
Hydraulic actuated rail wheels
Spring loaded car couplers
Magnet equipment

TWO MODELS — 15 and 20 TON
LITTLE GIANT CRANE AND SHOVEL, INC. Des Moines, Iowa 50333

LITTLE *Giant*

Distributed by:
Eastern Railway Supplies, Inc., Kingston, New Jersey
Stanley H. Smith & Co., Inc., Nicholasville, Kentucky
Transportation Products Co., Chicago, Illinois

W

Weller, R.C. (M'57), Area Engr., CNR
Toronto, Canada
Werner, R.J. (M'71), Gen. Fore. B&B, AT&SF
Newton, KS 67114
Westerman, C.J. (M'62), Engr. Br. Maint., SP
Sacramento, CA 95842
Wettstein, W.P. (M'82), Br. Designer, ATSF
Chicago, IL 60632
Wheeler, W.A. (M'83), Asst. Engr. Bridges
Southern, Atlanta, GA 30303
Whelihan, F.J. (A'83), Mfg. Rep.
20 N. Tower Rd., 6-E, Oak Brook, IL 60521
White, E.K. (M'61), B&B Supv., C&NW
St. Paul, MN 55101
White, S. (M'42, L'68), Ret. Gen. B&B Supvr., SP
1195 Cornell Ave., Berkeley, CA 94706
Whitehouse, B.M. (M'27, L'56), Ret. Ch. Fire.
Insp., C&NW, 3641 Sandhill Rd.
Las Vegas, NV 89121
Whitlock, W. (M'69), Asst. Gen. Fore., AT&SF
Silsbee, TX 77656
Whitney, N.E. (M'66), Engr. Civil Works, ICG
Chicago, IL 60601
Wiebler, H.E. (M'76), Wk. Equip. Maintainer, TP&W
Peoria, IL 61604
Wiemer, H.C. (M'57, L'77), Ret. B&B Engr., BN
4427 Powell Pl., South Seattle, WA 98108
Wilkerson, K.E. (M'84), B&B Supvr., MP
Buffalo, TX 75831
Wilkins, H.J. (M'83), Ch. Engr., BN
Billings, MT 59102
Willcoxon, P.W. (M'81), Civil Engr., NFEC
Alexandria, VA 22332
Williams, C.B. (A'54, L'75), Ret. Pres.
Ever Tight Bolt Assembly Co.
1106 Country Club Ct., No. 129
Bellevue, NE 68005
Williams, D.R. (M'56, L'78), Ret. B&B Supvr., CEI
Danville, IL 61832
Williams, J.M. (M'63), B&B Supvr., EJ&E
Gary, IN 46401
Williams, J.R. (M'59), Sr. Br. Engr.
Alfred Benesch & Co.
Chicago, IL 60601
Williamson, H.M. (M'60, L'75), Ret., SP
14 Contra Costa Pl., Oakland, CA 94618
Wilson, H.M. (A'53), Pres. F.K. Ketler Co.
438 W. 43rd Street, Chicago, IL 60609
Wingerson, C. (A'54, L'69), Ry. Sls. Engr
Screw & Bolt Div. of Modulus Corp.
Mckinley St., Pittsburgh, PA 15210
Wisinski, T.A. (A'79), Pres.
Marquette Bolt and Rivet Co., Inc.
8201 S. Wallace, Chicago, IL 60620
Witte, R.J., Jr., (A'84), Proj. Mgr.
Detzel Construction, 2160 Langdon Farm Rd.
Cincinnati, OH 45222
Wold, O.R. (M'57, L'80), Ret. B&B Supvr., BN
12311 S.E. McGillivray Blvd.
Vancouver, WA 98664
Wood, A.J. (M'67), Engr. Brs., SP
San Francisco, CA 94105
Wood, R.E. (M'54, L'73), B&B Supvr., BN
1995 Thompson Rd., Woodburn, OR 97071
Woodley, L.D. (M'83), B&B Supvr., BN
Lincoln, NE 68508
Worden, R.K. (M'54, L'78), Ret. Gn. Frm. B&B
ATSF, 3705 Sixth Ave.
Ft. Worth, TX 76110
Worley, B.J. (M'71), Ret. VP
Matl. Recovry. & Disp., CMSP&P
Deerfield, IL 60015
Wright, J.P. (M'77), Partner, Tylk. & Wright Assoc.
Clearwater, FL 33516
Wright, R.J. (M'75), Engr. Br. Design, CMSTP&P
Chicago, IL 60606

Y

Yaw, D.W. (M'51, L'69), Ret. Mast. Carp., EL
413 Heather Rd., Englewood, OH 45322
Yordy, C.S. (M'78), Sr. Str. Inspector, Conrail
Wallingford, PA 19086
Youhanaie, A. (M'84), Br. Engr., CMSP&P
Chicago, IL 60606
Young, C.W. (M'84), Sr. Constr. Inspector, Conrail
Detroit, MI 48216

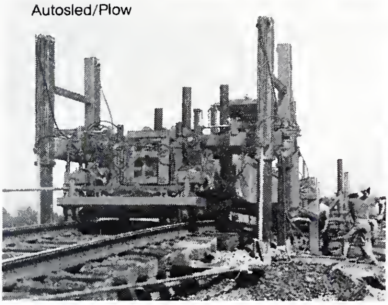
Z

Zillman, R.L. (A'85), Sales Mgr.
L&M Radiator Inc., 6966 Market St.
El Paso, TX 75601

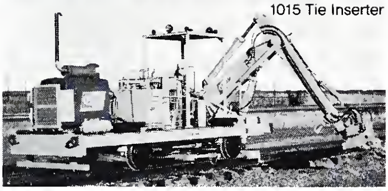
Shoulder Ballast Cleaner

Double-Track Auto Plow

Autosled/Plow



Loram's LRT Rail Grinder



1015 Tie Inserter

SP-88 Rail Grinder

LORAM'S ALL-PRO TRACK REHABILITATION TEAM

Loram has not only built but actually developed some of our industry's most innovative track machinery. The sled, plow and shoulder ballast cleaner are examples of Loram ingenuity. They're part of a broad line of dependable track rehabilitation equipment that includes:

LORAM RAIL GRINDERS (24-, 36-, 72- and 88-stone models) grind down to the rail corrugation valleys instead of *into* them, as other grinding methods do. Loram grinders restore rail without wasting rail metal.

LORAM'S DOUBLE TRACK AUTO PLOW, which plows ballast to the field side of double-track territory, sets up faster than any competitive machine.

LORAM'S SHOULDER BALLAST CLEANER has the highest capacity of any machine on the market. It cleans ballast from the tie end to shoulder edge while a scarifier tooth breaks out fouled ballast. One pass and the track is broomed and ready to use.

LORAM'S AUTOSLED/PLOW, with plowing and sledding components built right in, can be set up fast—actually in about 11 minutes.

LORAM'S TIE INSERTER inserts five or more ties a minute and *can be easily adapted to handle concrete ties.* Design simplicity and very accessible parts make the 1015 easy to maintain and repair.

LORAM'S LRT RAIL GRINDER was built on a smaller scale especially for rapid transit systems. It's self propelled and self contained, operates with a crew of two.

For purchase or lease information contact:

LORAM MAINTENANCE OF WAY, INC.
3900 Arrowhead Drive • Hamel, Minnesota 55340
(612) 478-6014 • Cable LORAM; Telex 29-0391

LORAM

Nobody builds it tougher.
Or services it better.

MEMBERSHIP BY ROADS

Alaska

Stavenjord, R.U.

Alabama Public Service Commission

McCardle, T.W.

Algoma Central

Conventry, K.J.
Ramsauer, R.

Amtrak

Begnaud, R.A.
Bibly, K.C.
Dubois, G.S.
Eschenbach, J.P.
Karasay, T.
Koch, C.M.
Kulick, K.L.
Mentzer, H.T.
Michel, J.N.
Oncu, I.
Rood, C.L.
Sanders, M.R.
Stearman, J.
Walbrun, M.C.

Association of American Railroads

Cerny, L.T.
Conlon, P.C.L.
Grotz, W.A., Jr.

Atchison, Topeka & Santa Fe

Armenta, C.G.
Barrett, P.L.
Beattie, G.W.
Boyd, J.E.
Brooks, R.L., Jr.
Burns, B.T.
Burris, H.A.
Byers, W.G.
Charrow, A.M.
Clark, K.L.
Crawford, J.D.
Crutchfield, W.T.
Dick, S.M.
Dout, K.R.
Draper, B.L.
Fraise, J.D.
Gibbs, R.R.
Gilley, C.E.
Gosney, F.M.
Green, H.W., Jr.
Green, R.W.
Groh, C.W.
Hale, R.
Hamilton, W.A.
Hanes, R.M.
Harvey, D.E.
Haven, P.
Herren, G.H.
Husbands, G.E.
Irby, C.E.
Johnson, B.B.
Johnson, J.M.
Johnson, W.E.
King, B.J.
Kwong, H.G.
Lake, G.D.
Laughlin, B.B.
Line, A.G.
Lozano, D.E.
Main, E.W.
Martens, H.F.
Mascorro, F.F.
McFarland, D.E.
Morris, D.A.
Newberry, A.C.
Nickerson, C.A.
Price, R.W.
Quesada, J.M.
Releford, C.R.
Rogers, S.M.
Rotondo, E.J.
Rundell, L.E.
Smith, C.D.
Tanner, R.J.
Truitt, G.T.
Wahlen, C.R.
Webb, H.G.
Werner, R.J.
Wettstein, W.P.
Whitlock, W.

Atlanta & St. Andrews Bay

Davis, D.R.

Bangor & Aroostook

Anthony, O.D.
Baker, B.C.
Picken, A.R.

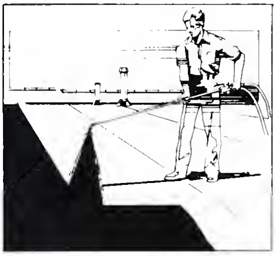
Belt Railway Co. of Chicago

Napoli, Jr.
Murray, D.J.

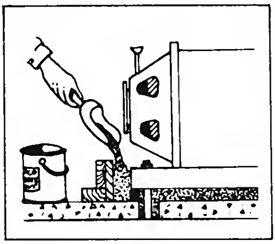
Bessemer & Lake Erie

Diersen, L.M.
Dobranetski, E.B.
Greco, E.F.
Longiotti, P.
McBrien, W.H., Jr.
Partilla, J.S.
Robertson, J.G.
Snyder, J.D.

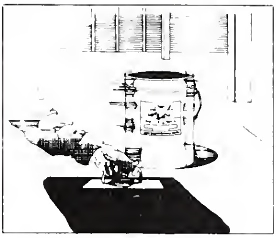
MIPCO *INDUSTRIAL MAINTENANCE MATERIALS*



ROOFING



GROUTING



FLOORING

MIPCO CAN PROVIDE AN ECONOMICAL SOLUTION TO YOUR MAINTENANCE PROBLEMS !

• ***Waterproof Coatings*** • ***Paving Materials*** • ***Concrete Sealers***

Serving Railroads and Industry Since 1945

MIPCO

CALL COLLECT OR WRITE TODAY FOR FREE PRODUCT MANUAL

MIDWEST INDUSTRIAL PRODUCTS CORP.
3818 NORTH CLARK ST. • CHICAGO, ILLINOIS 60613
Phone: Area Code (312) 348-2950

OSMOSE®

RAILROAD DIVISION
P. O. Box 8276 • Madison, Wisconsin 53708
608/221-2292 • 800/356-5952

THE BRIDGE PRESERVERS

Renovation of Timber & Concrete Bridges

★ INSPECTION
★ TIMBER IN-PLACE PRESERVATIVE TREATMENT
★ REPAIR

Birmingham Southern

Carver, D.W.

Boston & Maine

Lancaster, J.E.
Love, J.J.
Pierce, C.D.

British Columbia

Frost, J.S.C.
Griffin, L.B.
Kleywegt, H.S.

Burlington Northern

Boileau, R.J.
Borg, M.T.
Bowman, H.R.
Bruestle, K.E.
Carter, R.W.
Dahlin, W.G.
Davidson, J.W.
Dawson, E.J.
Driscoll, D.J.
Eoff, T.E.
Ford, L.G.
Gustafson, J.A.
Haug, G.E.
Hendrickson, L.D.
Johnson, M.L.
Jordan, C.D.
Krause, R.D.
Lees, H.M., Jr.
McCammon, D.L.
McCoy, D.E.
Millsap, S.A.
Nelson, W.H.
Rimmereid, J.J.
Roth, D.B.
Sartore, D.V.
Schapp, R.D.
Smith, T.J.
Wilkins, H.J.
Woodley, L.D.

Canadian National

Brownlee, W.R.
Fraser, R.A.
Frederick, G.R.
Katcher, G.W.
Lupkus, S.
Makarowski, O.S.
O'Connor, B.J.
Uppal, A.S.
Weller, R.C.

Canadian Pacific

Bryaliuk, D.
DeRosier, N.S.
Jaatteenmaki, E.T.
Thompson, C.E.

Canadian Transport Commission

Spicer, C.

Cartier

Michaud, S.A.

Chessie System

Brashares, R.E.
Clark, T.H.
Goodman, C.L.

Chicago & Illinois Midland

Johnson, A.R.
Pearson, R.E.

Chicago & North Western

Andrews, D.J.
Bhardwaj, P.L.
Billings, J.D.
Dunn, T.V.
Eich, K.W.
Frickenstein, B.
Hahn, H.D.
Hanges, J.P.
Iwinski, J.R.
Jensen, P.K.
Jurzak, T.A.
Knuth, G.A.
Kuston, L.A.
Ladner, D.R.
Lager, T.J.
Lawson, C.J.
Lawton, R.R.
Meisner, D.C.
Nelson, R.D.
Niemeyer, T.M.
Nitzschke, R.D.
Olson, D.D.
Rankel, V.J.
Saletnik, P.H.
Snyder, R.E.
Steiner, G.
Tiesling, A.J.
Van Huis, J.A.
White, E.K.

FIND RAILROAD CONTRACTORS AND SUPPLIERS

FAST

NRC
The National
Railroad Construction
and Maintenance
Association, Inc.

CAN HELP YOU FIND THE BEST
IN RAILROAD CONSTRUCTION

Looking for railroad contractors and suppliers? NRC will help you locate them, through our exclusive computerized Railroad Construction Buyer's Service Center.

For contractors who will fit your bridge needs, building and track maintenance or new construction, call or write Daniel D. Foth, 6989 Washington Avenue South, Suite 200, Edina, MN 55435.

US 800-328-4815
MN 800-752-4249
612-941-8693

"ASK FOR NRC"

Chicago, Milwaukee, St. Paul & Pacific

Bolwahnn, L.O.
Davis, R.R.
Doherty, G.D.
Duquaine, D.J.
Franz, D.K.
Fronczak, R.E.
Klouda, R.G.
Lund, C.R.
Markvaldas, T.E.
Murphy, M.D.
Smith, N.E.
Stanley, J.F.
Wright, R.J.
Youhanaie, A.

Chicago Union Station

Bibly, K.C.

Conrail

Anderson, B.
Anderzunas, P.P.
Bradley, M.L.
Campbell, J.A.
Castrucci, A.
Chan, W.
Conklin, R.J.
Day, F.D.
Fatula, P.
Gunkle, W.J.
Hool, D.K.
Jess, G.
Kapp, J.T.
Kappel, F.
Keller, J.C.
Lurcott, E.T.
McMaster, M.C.
Morey, C.F.
Petroski, G.J.
Reynolds, T.A.
Richter, J.S.
Schoen, W.F.
Virrill, W.G.
Wagner, W.R.
Yordy, C.S.
Young, C.W.

Delaware & Hudson

Conroy, R.P.
Hoadley, D.E.
Mattice, J.E.

Denver & Rio Grande & Western

Meek, H.V.

Duluth, Missabe & Iron Range

Anderson, D.A.
Gabelman, P.D.

Duluth, Winnipeg & Pacific

Tack, H.

Elgin, Joliet & Eastern

Baker, R.C.
Krakar, A.M.
La Beau, J.A.
Marlow, M.J.
Nelson, H.F.
Sliepka, R.B.
Sturm, W.C.
Toftoy, D.K.
Viehweg, P.F.
Williams, J.M.

Federal Railroad Administration

Davids, G.A.
Evans, T.E.
Moore, R.M.
Paxton, W.R.

Florida East Coast

Frederick, E.R.
Sheldon, E.B.

Grand Trunk Western

Jacobs, T.F.
Johnson, A.E.
Patel, N.S.
Rosenkrantz, F.E.

our specialty. . .

effective signs for the Railroad and Transportation Industry . . . crossbucks, caution, depot & station, track, targets, caboose markers, trade mark decals, any standards, plus caution styles that you may be considering . . . we can make them ALL . . . and at sensible, economical prices!

PPSC

"Service so good . . . it's Better than having your own sign shop!"

POWER PARTS *Sign* COMPANY

1860 North Wilmot Avenue • Chicago, Illinois 60647 (312) 772-4600 • TWX 910-221-5507

Illinois Central Gulf

Bailey, J.
Buchko, D.E.
Budzileni, J.
Deady, P.F.
Drier, D.C.
Ford, P.V.
Helm, J.M.
Krupa, G.E.
Lewis, D.J.
Maupin, A.J.
Nesbitt, S.A.
Noyszewski, M.
Smith, J.H.
Stokely, W.S.
Stokes, W.F.
Whitney, N.E., Jr.

Indiana Harbor Belt

Dziak, J.E.
Mathias, H.O.

Kansas City Southern

Brookings, D.W.
Lasley, D.E.

Kansas City Terminal

Carver, H.H.
Ross, C.E.

Lake Superior & Ishpeming

Stokke, T.O.

Long Island

Costantino, A.A.
Donegal, A.O.
Dwinnel, W.B.
Schwab, B.R.

Mahaweili Railways

Weerasuriya, J.P.

Maine Central

Jordan, S.L.
Potter, R.H.

Metro-North

Fleres, A.M.

Missouri-Kansas-Texas

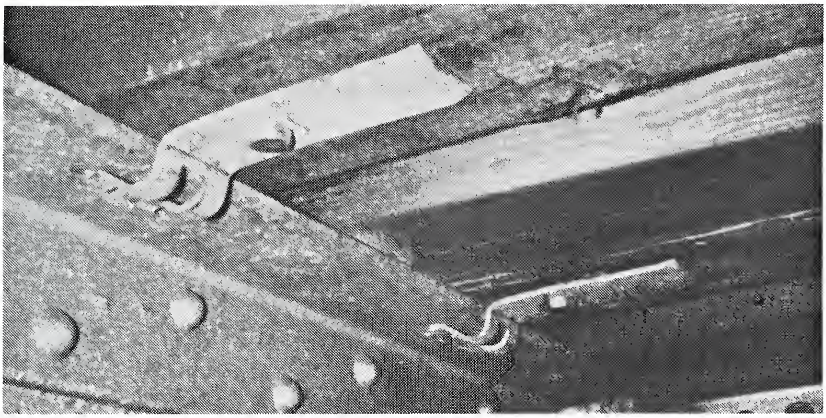
Gardner, W.E.

Missouri Pacific

Adams, D.A.
Bateman, J.D.
Brakensiek, W.E.
Caley, D.L.
Cunningham, W.P.
Cushman, D.G.
Dreiling, R.G.
Dunsworth, J.E.
Elizondo, A.
Elliott, W.H.
Groves, G.R.
Hartselle, R.
Heavin, J.W.
Kessler, E.E.
Kuhn, T.E.
LaRose, A.E.
Loyd, T.R.
Munoz, J.M.
Nelson, J.H.
Perry, G.E.
Raymond, J.R.
Shaw, D.E.
Smith, N.A.
Stander, N.R.
Stead, M.E.
Steelman, H.C.
Thompson, W.C.
Wallace, J.W.
Welch, K.R.
Wilkerson, K.D.

Norfolk & Western

Beirne, J.M.
Bond, E.
Goewey, C.T.
Heinrich, T.C.
Janosko, G.R.
Lemanski, F.G.
Shaver, J.R.



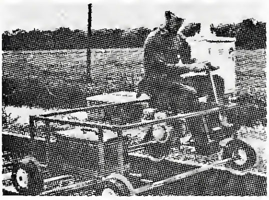
BRIDGE TIE ANCHORS

Effective holding power for welded steel bridges

Rails Co. Bridge Tie Anchors have been an industry standard for more than 25 years. They exert strong spring tension which holds the tie and bridge member firmly together and prevents skewed ties, split guard rails, etc. The spring action compensates for shrinkage, seating and stresses caused by flexing of the tie under wheel loads.

RAIL ROD

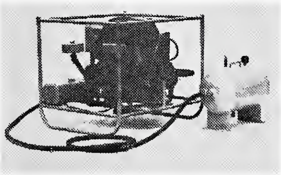
The one-man track cart that can be carried by one man.



Totally insulated, will not activate switches. Safety clutch and brake system. 2-wheel drive. Rugged construction. Folds up for shipping and storage. Proven on major class one railroads.

PORTABLE COMPRESSOR

Provides 55 cfm capacity moves easily from job to job...



Lightweight, engine-driven compressor is perfect for small jobs on a section gang – tamping, driving spikes, etc. Completely self-contained, mounted in high-strength steel tubing frame. 36″ l x 31″ w x 32″ h., only 300 lbs.

THE RAILS CO.

Maplewood, NJ 07040
Chicago, IL 60604 • Roswell, GA 30075
Rutherford, CA 94578 • Forest Grove, OR 97116
Canada: IEC-Holden Co., Ltd.

Northeast Illinois Rail Corporation

Lorenzini, J.L.
Pebler, J.A.
Sumner, S.A.

Ontario Northland

Everitt, S.J.
Porter, D.C.
Spencer, B.S.

Pittsburgh & Lake Erie

Bhalakia, M.

Philadelphia, Bethlehem & New England

Rauch, D.L.

Providence & Worcester

Fetterman, P.

Regional Transportation Authority

Pitzen, G.B.

Richmond, Fredericksburg & Potomac

Hobbs, J.C.
Smith, J.R.

Seaboard System

Binkley, W.O.
Brown, J.D., Jr.
Carter, A.B.
Frame, R.E.
Mooney, A.E.
Neece, J.L.
Oram, D.A.
Rains, J.E.
Sheffield, J.J.
Seay, F.S., Jr.
Soles, J.E.

Southern

Bonas, D.J.
Bradley, J.G.
Buchanan, R.S.
Buckley, S.J., III
Calhoun, J.C.
Carpenter, S.R.
Cochran, D.O.
Doss, P.R.
Edwards, J.W.
Ellison, J.
Hauschildt, K.G.
Hille, M.A.
Kingrey, R.H.
Kriegel, H.G.
Lamkin, J.R.
Lee, R.W.
Lloyd, H.R.
Luzier, W.B.
McGill, J.A.
Moore, D.W.
Patton, R.D.
Phillips, R.E.
Pritchett, J.S.
Russell, C.M.
Sarris, P.T.
Shepherd, J.R.
Small, F., Jr.
Stoker, R.G., Jr.
Tallent, R.A., Jr.
Wheeler, W.A.

Southern Pacific Transportation Co.

Banks, E.G.
Karsten, R.D.
King, L.E.
Lynch, J.F., Jr.
McGinley, M.E.
Moore, D.L.
Murdock, G.L.
Walls, D.R., Jr.
Westerman, C.J.
Wood, A.J.

Terminal Railroad Association of St. Louis

Vines, H.

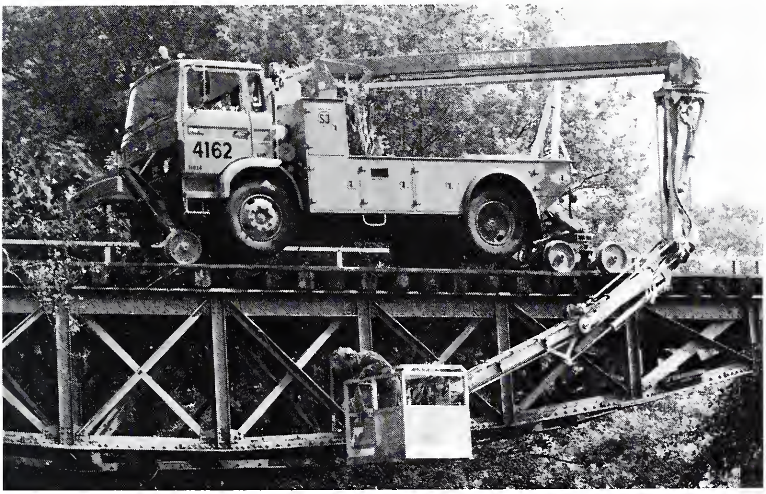
Toledo, Peoria & Western

Wiebler, H.E.

Union

Smithberger, T.P.

THE *"EFFICIENT"* ONE



The SRS Bridge Inspection/Maintenance Vehicle

The one you've always wanted and needed for efficient, high-productivity bridge inspection.

- Diesel power, plenty of it (175 hp)
- 2-man basket, 500 lb. capacity
- Goes down 24 ft., up 18 ft.
- Gets on at *any* crossing in 2 minutes
- 45 m.p.h. on rail, both directions
- Driven from basket when working
- Power for lights, hydraulic, and air tools
- Many more unique and valuable features

CAN BE RENTED

CONTACT:

SRS

SRS AMERICA CO.

P.O. Box 839 • Southbury, CT 06488 • Tel: (203) 748-5580

REPRESENTATIVES IN:
Chicago, IL: (312) 922-8515
Omaha, NE: (402) 330-2972
Syracuse, NY: (315) 437-6371
Ambler, PA: (215) 643-4755

IN CANADA:
Vale-Harmon Enterprises Ltd.
375 Bord du Lac
Dorval, P.Q. H9S2A5
Tel: (514) 636-1026

Union Pacific

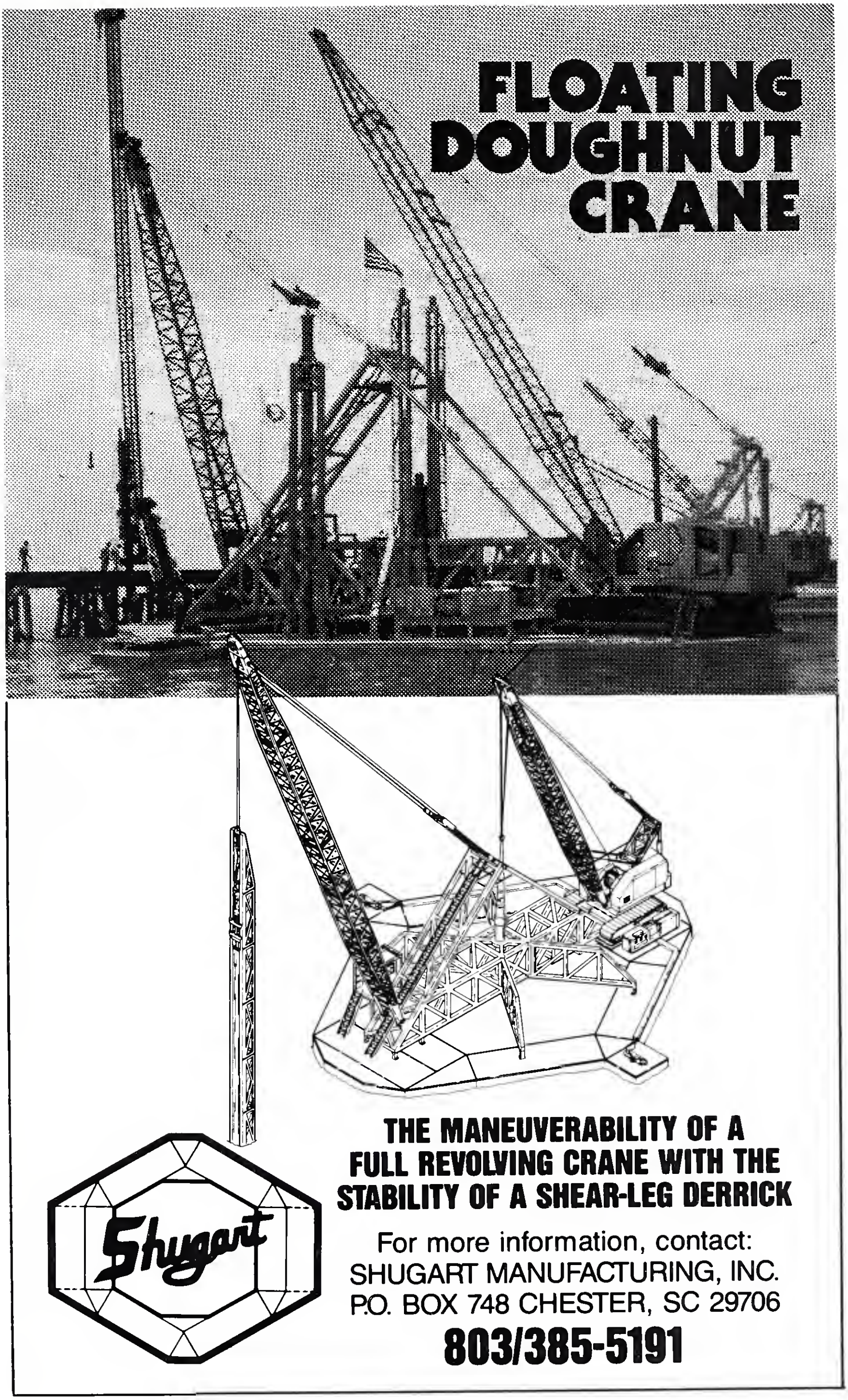
Aylward, P.E.
Beebe, L.C.
Benson, D.D.
Beran, J.R.
Broglen, L.E.
Chambers, R.J.
Chiodo, G.S.
Crisp, J.C.
Deterding, D.L.
Edwards, G.
Grant, G.H.
Gray, J.L.
Hoppell, V.E.
Horney, J.J.
Humphries, A.
Jensen, A.H.
Kenyon, R.S.
Kerr, K.S.
Kuhn, R.C.
Leach, L.J.
Lelevich, L.E.
Lileikis, J.A.
Liston, C.L.
McKenzie, L.E.
Miller, D.E.
Nordstrom, R.D.
Peters, D.R.
Reeder, D.T.
Saxton, C.L.
Schlehuber, R.L.
Smedley, E.F.
Steele, D.L.
Updike, D.E.
Waltemath, T.F.

The Washington Terminal Company

Kershner, D.L.
Phillips, L.A.

MISCELLANEOUS MEMBERS

Anderson, T.C., Schnabel Foundation Co.
Bessey, D.A., Envirodyne Engineers, Inc.
Bigelow, R.B., Cole Associates
Blank, S., Imperial Manor Associates
Burrows, F.G.A., California State University
Bush, K.L., Horner & Shifin Consulting Engineers
Cecchi, D.G., Collins Engineers, Inc.
Clary, A.G., Academy of Sciences, Transportation Research Bd.
Darnell, K.E., Geologic Associates, Inc.
DeBerg, D.G., Consultant
Dennewald, R., TradeARBED
Dolby, A.J., Dolby and Associates, Inc.
Dresden, A.S., 1102 Sprucewood, Mt. Prospect, IL 60056
Erickson, N., Capitol Engineering Corp.
Gilbertsen, H., Consultant
Gould, J.H., Rust International Corp.
Hague, C.H., Alfred Benesch & Co.
Hemingway, W.J., Gene Sitter Corp.
Hollander, D., U.S. Army Corps.
Hughes, C.A., Civil Engineer
Jackman, C.E., Transportation Consultant
Knuth, D., CRS Sirrine Engineers
Layer, J.P., R.W. Consultants, Inc.
Macfarlane, I.B., Dept. of Trade, Australia
MacFarland, J.A., McFarland-Johnson Engineers
McFarlin, R.J., Bakke Copp Ballou & McFarlin
Meeker D.L., 728 S. 33rd St., Mattoon, IL 61938
Michael, R.G., CDC Services, Inc.
Miedtke, D.R., Ellerbe
Nash, W.R., McCarthy Bros. Co.
Nelson, A.F., Gannett Fleming Inc.
Nicolau, A.M., Steinman Consulting Engineers
Osterling, A.W., Consultant
Parker, T.J., Envirodyne Engineers, Inc.
Parvin, C.F., Consulting Engineer
Payne, R., ESCA Consultants
Schlueter, G.A., Railway Track & Structures
Semioli, W.J., Railway Track & Structures
Skoglund, E.E., Schnabel Foundation Co.
Solarte, H., Arrendo, Epperson, Solarte & Brunz Inc.
Sorenfrei, D.F., Modjeski and Masters
Sparrow, R.W., Jr., Schnabel Foundation Co.
Stewart, B.J., Park, Hayden & Assoc., Inc.
Storey, H.E., National Transportation Board
Tysinger, G.L., Tysinger Engineering
Venuti, W.J., San Jose State University
Willcoxon, P.W., Naval Facilities Engineering Comm.
Williams, J.R., Alfred Benesch & Co.
Wright, J.O., Tylk and Wright Associates



FLOATING
DOUGHNUT
CRANE

THE MANEUVERABILITY OF A
FULL REVOLVING CRANE WITH THE
STABILITY OF A SHEAR-LEG DERRICK

Shugart

For more information, contact:
SHUGART MANUFACTURING, INC.
P.O. BOX 748 CHESTER, SC 29706
803/385-5191

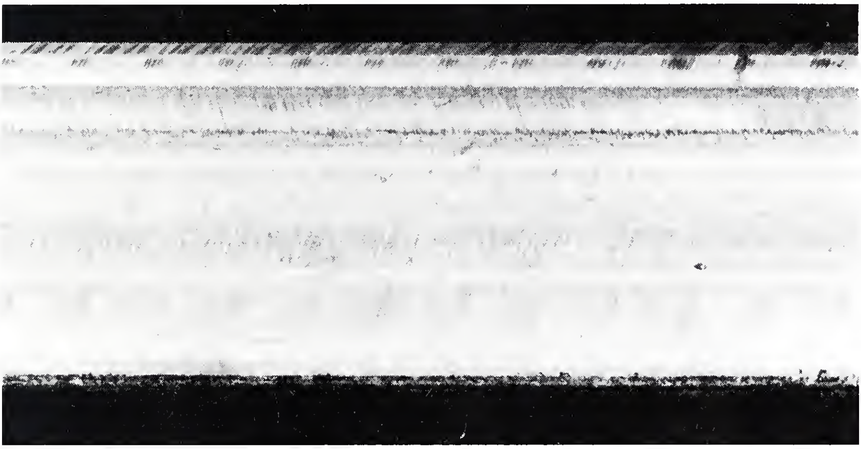
HONORARY MEMBERS

Armstrong, W.F.
Denz, O.C.
Devalle, J.W.
Dick, M.H.
Gunderson, R.R.
Huffman, W.H.
Jorlett, J.A.
Runde, E.E.
Schlaf, E.R.

LIFE MEMBERS

Arnold, L.K.
Baker, F.A.
Barr, A.S.
Barsema, M.
Bartley, C.W.
Beaver, J.F.
Bechly, D.S.
Bell, D.V.
Beringer, M.A.
Bertel, D.J.
Billmeyer, E.D.
Bishop, D.B.
Boehling, H.A., Jr.
Born, J.O.
Bowman, R.M.
Bradfield, R.G.
Brietzke, W.F.
Brown, R.M.
Bryant, N.D.
Buckmaster, W.A.
Burch, E.E.
Burleson, H.S.
Burpee, C.M.
Camelle, E.J.
Carlson, A.W.
Carter, J.W.
Cary, N.M.
Celander, H.W.
Chamberlain, P.
Chambers, J.W.
Christensen, M.C.
Clark, W.H.
Cook, J.C., Jr.
Cummins, C.P.
Cummings, L.
Davis, H.E.
Diehl, C.M.
Dixon, C.E.
Duchac, J.V.
Duncan, F.
Durrant, H.B.
Eargle, J.M.
Eichenlaub, C.M.
Elliott, C.E.
Erskine, J.A.
Fairchild, E.H.
Foreman, J.E., Jr.
Forseth, C.E.
Fort, O.E.
Franzen, E.T.
German, J.G.
Gipson, C.G.
Goforth, J.A.
Golem, G.G.
Gould, D.C.
Haines, W.W.
Hawley, I.H.
Hedley, W.J.
Hellweg, R.D.
Hodgkins, E.W.
Hogel, E.C.
Hornig, F.F.
Howard, J.G.
Howe, A.K.
Hubbard, M.J.
Humphreys, R.W.
Hunter, A.L.
Hutcheson, T.B.
Hutcheson, W.A.
Hutton, J.E.
Hyma, W.R.
Iler, F.C.
Jackson, T.E.
Jenkins, H.W.
Johnson, A.C.
Johnson, E.A.
Johnson, H.T.
Jones, W.J.
Julius, H.R.
Kendall, J.T.
Kvenberg, S.E.
Langham, L.D.
Laurick, M.J.
Layer, J.P.
Linn, G.A.
Lokotzke, G.P.
Long, W.R.
Lowry, J.M.
Lund, C.V.
Mabry, D.B.
Martin, J.W.
Martyn, G.W.
McMaster, R.C.
Messman, D.V.
Meyers, B.R.
Miller, J.C.
Mimick, F.A.
Monahan, E.L.
Moore, I.A.
Myers, E.T.
Myers, R.L.
Oest, W.C.
Ostrom, W.D.
Owens, R.F.
Packard, B.G.
Pahl, W.H., Jr.
Parrish, O.S.
Patterson, C.D.
Patterson, J.M.
Perrier, J.L.
Presthus, E.J.
Pritchard, B.L.
Prude, G.F.
Raessler, V.D.
Rainer, A.L.
Rainey, W.H.
Rankin, W.H.
Rees, F.L.
Reger, J.H.
Robinson, G.E.
Rothell, R.D.
Safley, J.R.
Salmon, J.M., Jr.
Sathre, C.O.
Saunders, T.D.
Schlicher, G.K.
Schmitz, J.R.
Scott, G.E.
Seley, L.L.
Seltzer, J.R.
Shamblin, R.E.
Short, W.L.
Simonsen, E.F.
Sinclair, C.H.
Slagle, G.P.
Smedley, V.N.
Smith, J.
Smith, R.H.
Sorensen, N.N.
Stade, A.F.
Stephens, T.J.
Swanson, W.C.
Switzer, G.
Termunde, W.L.
Tetreault, L.J.
Thatcher, C.H., Jr.
Thum, W.A., Jr.
Tieman, L.G.
Trulove, J.D.
Tucker, N.R.
Tustin, E.O.
Tyckoson, E.G.
Tyler, W.R., Jr.
VanScoyoc, L.
Von Behren, G.
Wachter, C.E.
Waisanen, R.M.
Wall, R.
Wang, A.B.
Warfield, H., Jr.
Warfield, W.B.
White, S.
Whitehouse, B.M.
Wiemer, H.C.
Williams, C.B.
Williams, D.R.
Williamson, H.M.
Wingerson, C.
Wold, O.R.
Wood, R.E.
Worden, R.K.
Yaw, D.W.

PROFILES IN RAIL LIFE: SPENO



Speno's exhaustive research into the science of rail grinding pays dividends in our ability to restore optimum rail profile, often virtually doubling its performance life.

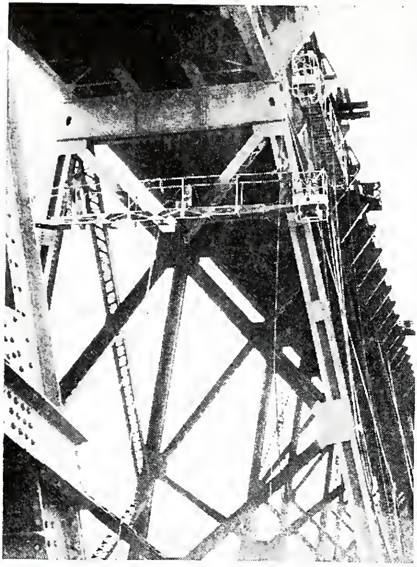
Best results are possible only through effective equipment control, and Speno's reprofiling techniques have it. Speno's Autoload™ control automatically maintains optimum effectiveness of all grinding wheels — without manual adjustment.

Speno's patented Active Long Wave system, with positive pressure control, assures pinpoint action on high or low welds and other similar defects. The result: continuously varied grinding effort according to need.

For the full benefit of a planned rail maintenance program, rely on Speno experience and technology. We save the rails.

Speno

Speno Rail Services Co.
P.O. Box 309
East Syracuse, New York 13057
(315)437-2547



40% SAVED—The Chicago and North Western Railroad, through the use of modern material and equipment, reduced their bridge painting costs by 40%.

WOULD YOU BELIEVE! This one man painted more area than five men working from a multi-deck scaffold on the opposite side of the bridge.

All photos illustrative only. Products must be used in conformity with safe practices and applicable codes and regulations. All Spider Staging equipment that is UL listed is so labeled.

RENTAL AND SALES

Spider Staging Sales Co.

P.O. Box 182 Renton, Washington 98057 206-255-8267

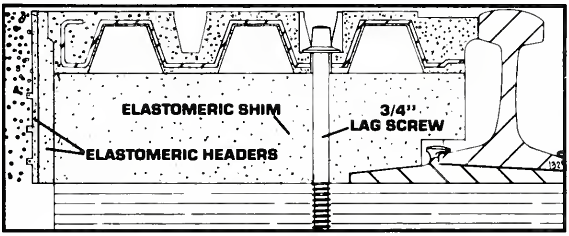
SPIDER BRANCHES

Atlanta, GA
Boston, MA
Chicago, IL
Cleveland, OH
Dallas, TX
Detroit, MI
Houston, TX
Los Angeles, CA
New Orleans, LA
New York, N.Y.
Orlando, FLA
Philadelphia, PA
San Francisco, CA
St. Louis, MO

CANADIAN SUBSIDIARY: Vancouver, B.C.

SAF&DRI RUBBER CROSSINGS

- **ELASTOMERIC SHIMS**
- **ELASTOMERIC HEADERS ONE PIECE CURB TO CURB**
- **GALVANIZED ¾" LAGS**



Recent product developments are now available for railroad use. Elastomeric shims are designed to accommodate the shock of impact loads caused by heavy vehicles at high speed. The elastomeric shim, unlike a timber shim, will flex and rebound without splitting and is impervious to water.

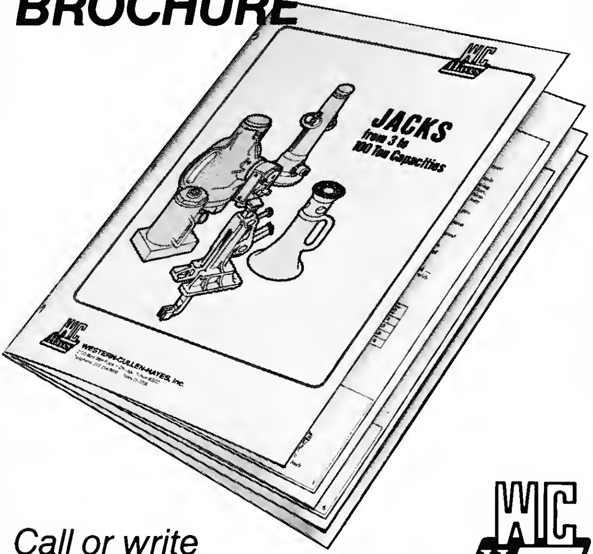
Research and development of new and innovative concepts along with improved methods for utilizing traditional materials, continue at Structural Rubber. As new concepts are proven and performance tested, the application of the developments in field installations continues to keep SAF&DRI the industry leader.

STRUCTURAL RUBBER PRODUCTS COMPANY

217/753-2960 • P.O. BOX 2439 • SPRINGFIELD, IL 62705

JACKS THAT WORK
Western-Cullen-Hayes

SEND FOR FREE BROCHURE



Call or write

WESTERN-CULLEN-HAYES, Inc.

WC Hayes

MEMBER RPI RAILWAY PROGRESS INSTITUTE

2700 West 36th Place • Chicago, Illinois 60632
Telephone: 312/254-9600 • Telex 25-3206

BKBM

BAKKE KOPP BALLOU & McFARLIN, INC.
PROFESSIONAL ENGINEERS

219 North Second Street
Minneapolis, MN 55401
612/333-7101

106 North Main
LeSueur, MN 56058
612/665-6486

ab

alfred benesch & company
CONSULTING ENGINEERS

233 NORTH MICHIGAN AVENUE, CHICAGO, ILLINOIS 60601
312 / 565-0450

Offices Indianapolis, IN/Kenosha, WI

Booker
Engineers Architects Planners

Booker Associates, Inc.

1139 Olive St.
St. Louis, Mo. 63101
(314) 421 - 1476

Lexington, Kentucky
Wichita, Kansas
Oklahoma City, Oklahoma

BUCHER, WILLIS & RATLIFF
CONSULTING ENGINEERS, PLANNERS & ARCHITECTS

Engineering Planning Architecture

609 WEST NORTH STREET SALINA, KANSAS 67401 913/827-3603
9140 WARD PARKWAY, SUITE 100 KANSAS CITY, MO 64114 816/363-2696
2209 CANTERBURY DRIVE HAYS, KANSAS 67601 913/628-8712
110 SOUTH MADISON MT. PLEASANT, TX 75455 214/572-1846
3310 SOUTH BROADWAY, SUITE 202 TYLER, TX 75701 214/592-4311

**COWIN & COMPANY, INC.
MINING ENGINEERS
AND CONTRACTORS.**

Tunnels

- **Construction**
- **Repair**
- **Enlargement**
- **Consulting**

EST. 1924

301 INDUSTRIAL DR., P.O. BOX 19009
BIRMINGHAM, AL 35219-9009
PHONE: (205)945-1300

DHA

Delon Hampton & Associates

Engineer Architects Planners

222 West Adams Street Chicago, Illinois 60606 312 899-1146

Washington Rockville Los Angeles Orlando

**DeLEUW
CATHER**

Engineers and Planners

De Leuw, Cather & Company

1211 Connecticut Ave., N.W.
Washington, D.C. 20036
(202) 828-3800
Telex: 440413

525 West Monroe Street
Chicago, Illinois 60606
(312) 930-5100
Telex: 4330161

Offices Worldwide

ENVIRODYNE ENGINEERS

a professional consulting services firm

- transportation engineering
- environmental engineering
- analytical services
- energy engineering
- construction management

168 North Clinton Street
Chicago, Illinois 60606
(312) 648-1700

Baltimore / New York / St. Louis

ESCA CONSULTANTS, INC.

1606 WILLOW VIEW RD. P.O. BOX 159
URBANA, ILLINOIS [217] 384-0505

RAILROAD & HIGHWAY BRIDGES · TRACKWORK
INDUSTRIAL FACILITIES · SPECIAL STRUCTURES

INSPECTION & RATING
REPORTS & STUDIES
DESIGN & PLANS
CONSTRUCTION SUPERVISION

Gannett Fleming
ENGINEERS AND PLANNERS

Bridges • Tunnels • Trackwork
Electrification • Yard and Shops

P.O. Box 1963 Harrisburg, Pa. 17105
Regional Offices Located in 27 Other Cities

HDR Infrastructure
A Centerra Company

8404 Indian Hills Drive
Omaha, Nebraska 68114
(402) 399-1000

Bridges
Highways and Railways
Hazardous Waste
Industrial Facilities
Environmental

HARDESTY & HANOVER
Consulting Engineers
BRIDGES—FIXED AND MOVABLE
HIGHWAYS AND RAILWAYS • SPECIAL STRUCTURES
DESIGN, INSPECTION, VALUATION
1501 Broadway, New York, N.Y. 10036
Jersey City, N.J.

"HYDRO CONDUIT CORPORATION"

PRESTRESSED CONCRETE DIVISION

P.O. Box 1609
Albuquerque, N.M. 87103

SUPPLIER OF PRESTRESSED CONCRETE
BRIDGE SLABS, GIRDERS & PILING
TO AMERICAN RAILROADS SINCE 1958

F. K. KETLER CO.

RAILROAD BRIDGE CONTRACTORS

EXTRAORDINARY MAINTENANCE ON FIXED OR
MOVABLE SPANS

Repair or Replacement of Bearings and Operating Machinery
Reboring Pin Holes and Pin Replacement
Eyebar Tension Adjustment, Steel Repairs

440 W. 43rd Street **Chicago, IL 60609**

MODJESKI AND MASTERS

CONSULTING ENGINEERS

Fixed and Movable Bridges
Structures, Foundations, Mass Transportation, Port Facilities

Design and Inspection of Construction
Inspection of Physical Condition and Rating
Strengthening, Rehabilitation, Reconstruction

Post Office Box 2345, Harrisburg, PA 17105
(717) 761-1891

New Orleans, LA
Bordentown, NJ

Poughkeepsie, NY
Charlotte, NC

PAVLO ENGINEERING COMPANY
CONSULTING ENGINEERS
STUDIES — DESIGN
CONSTRUCTION INSPECTION
Highways • Bridges • Airports • Marine Structures • Municipal Works
Recreation • Transportation Systems • Environmental Engineering
469 Seventh Ave., New York, N.Y. 10018 **(212) 239-0250**

PRC Engineering
Bridges Freight Systems Railroads Rapid Transit
300 E. 42nd Street New York, NY 10017 (212) 986-2700
303 E. Wacker Drive Chicago, Illinois 60601 (312) 938-0300
prc Planning Research Corporation

SHANNON & WILSON, INC.
Geotechnical Consultants
Engineering And Applied Geosciences

Landslide Evaluation & Correction • Embankment & Subgrade Stabilization • Tunnel Design & Maintenance • Waste Management • Bridge Foundation Engineering

Seattle • Portland • Spokane • Fairbanks
Anchorage • St. Louis
Corporate Headquarters, Seattle: (206) 632-8020
1105 N. 38th, P.O. Box C-30313, Seattle, WA 98103-8067

STV/Seelye Stevenson Value & Knecht
Engineers and Planners

TRANSPORTATION SPECIALISTS

Highway • Bridge • Rail • Bus • Airports

Headquarters: 225 Park Avenue South, New York, NY 10003, 212/777-4400
Office Locations: Los Angeles, CA • Boston, MA • Stratford, CT • Rochester, NY
Plainview, NY • Chicago, IL • Jersey City, NJ • McLean, VA

Urban Engineers, Inc.
Multidisciplinary Consultants

300 North 3rd Street
Philadelphia, Pennsylvania
19106-1193
Telephone (215) 922.8080

Camden, New Jersey
Erie, Pennsylvania
Buffalo, New York

BIBLIOGRAPHY OF CONTENTS

of Proceedings of

the

American Railway

BRIDGE & BUILDING

Association

1975-1984

VOLUME 80 (1975)

Committee Reports:

Trends Toward Bridges Built with Combination Timber, Concrete and Steel Components (J. G. Robertson, Chmn.)
Fire Protection Systems for Bridges and Buildings (W. E. Halley, Chmn.)
Controlling Water Pollution at Mechanical Facilities (W. J. Gunkle, Chmn.)
Selection and Maintenance Mechanical Facilities for Buildings (W. C. Sturm, O. C. Denz, F. D. Day, E. B. Dobranetski and J. L. Gray)

VOLUME 81 (1976)

Committee Reports:

History of Railroad Bridge Development (James Budzileni, Chmn.)
Planning and Scheduling B&B Work (R. C. Force, Chmn.)
Problems Encountered In Remodeling Existing Buildings (W. C. Sturm, Chmn.)

VOLUME 82 (1977)

Committee Reports:

Replacing or Making Heavy Repairs to Bridges Having Continuous Welded Rail (W. W. Haines, Chmn.)
Effect of Unit Train Operation on Bridges (F. D. Day, Chmn.)
Maintenance of Branch Line Bridges (E. C. Patterson, Chmn.)

VOLUME 83 (1978)

Committee Reports:

Organization of Steel Bridge Gangs (B. T. Burns, Chmn.)
Criteria for Selection of Metal Versus Masonry Buildings (D. A. Bessey, Chmn.)
Waterproofing Railroad Bridges (J. M. Williams, Chmn.)
Steel Stringer Bridge Construction and Installing Under Traffic (C. M. Russell, Chmn.)

VOLUME 84 (1979)

Committee Reports:

Track Scales (W. J. Gunkle, Chmn.)
Clearance of Oversized Loads (J. C. Calhoun, Chmn.)
Methods for Reducing Energy Consumption in Existing Buildings (presented by Paul H. Saletnik)

VOLUME 85 (1980)

Committee Reports:

Bridge Inspection (D. R. Ladner, Chmn.)
Maintenance of Moveable Bridges (D. J. Lewis, Chmn.)
Selection of Interior & Exterior Material for Buildings (J. T. Kapp, Chmn.)

VOLUME 86 (1981)

Committee Reports:

Evaluation and Repair of Fire Damaged Steel Bridges (A. S. Uppal, Chmn.)
Renewing Caps on Ballast Deck Bridges (R. A. Tallent, Jr., Chmn.)
Prevention of Roofing Failures (K. N. Kerns, Chmn.)
Locomotive Fueling Spill Prevention and Spill Collection System (Howard Laga, Chmn.)

VOLUME 87 (1982)

Committee Reports:

Movement of Locomotive Cranes, (T. E. Kuhn, Chmn.)
Culvert Maintenance and Replacement, (D. R. Ladner, Chmn.)
Maintenance & Replacement of Bridge Bearings, (S. Lipkus, Chmn.)

VOLUME 88 (1983)

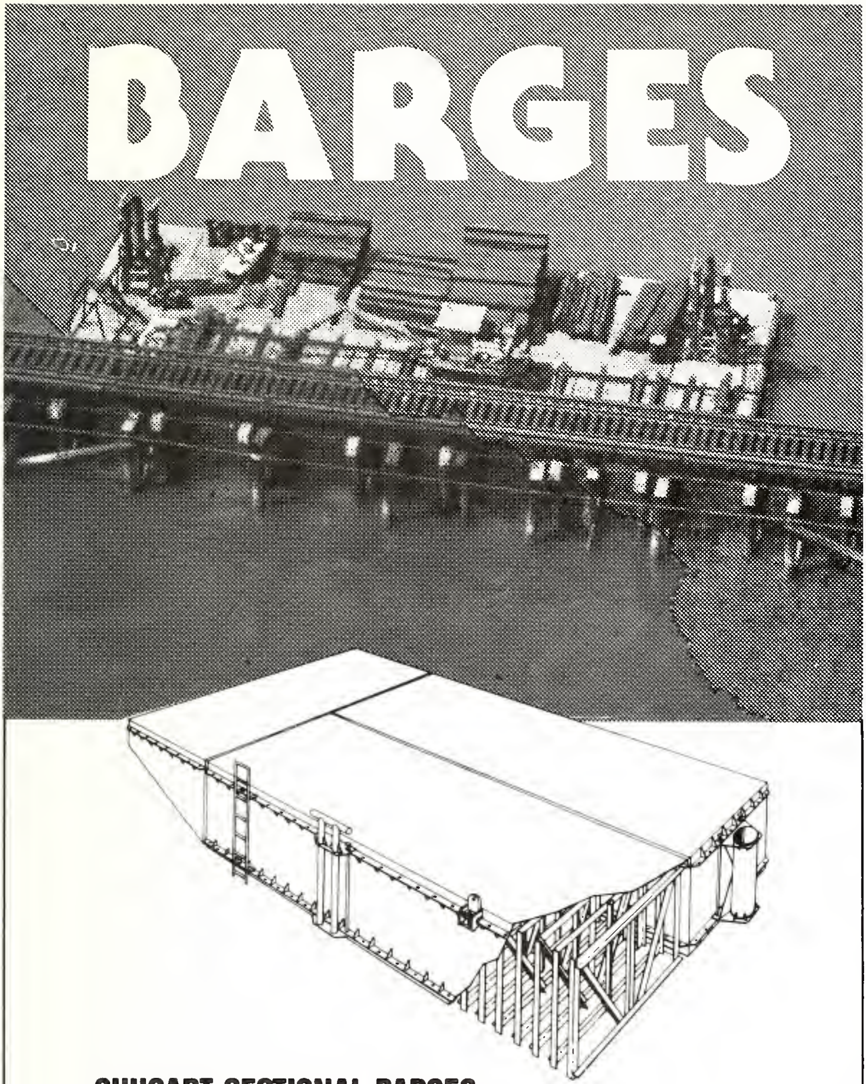
Committee Reports:

Slide Control and Prevention (J. E. Johnson, Chairman)
Replacement of Through Trusses (J. G. Bradley, Chairman)
Environmental Compliance and How It Affects B&B (W. P. Cunningham, Chairman)
Recycling Old Buildings (J. A. Campbell, Chairman)

VOLUME 89 (1984)

Committee Reports:

Installation or Replacement of Culverts (W.J. Grunkle, Sr., Chairman)
Building Audits and Insulation (J.H. Smith, Chairman)
Installing Ties on Open Deck Trestles and Bridges (D.L. Steele, Chairman)
Replacement of Timber Trestles with Permanent Structures (D.J. Lewis, Sr., Chairman)



SHUGART SECTIONAL BARGES
STURDY • VERSATILE • SECTIONAL • ADAPTABLE

Shugart

For more information, contact:
SHUGART MANUFACTURING, INC.
P.O. BOX 748 CHESTER, SC 29706
803/385-5191